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THE AGE AND GROWTH OF SALMON AND TROUT IN NORWAY

AS SHOWN BY THEIR SCALES

BY

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INTRODUCTION.

During the years 1898—1902, I carried out a series of investigations relating to the life-history of Salmon and Trout. The results were issued under the title of "Ørret og Unglaks" in 1902, and were afterwards published in English in the "Nyt Magasin for Naturvidenskaberne" B. 42, 1904, under the title of "A Study on Trout and Young Salmon."

The main result of my numerous investigations and experiments was briefly this: that salmon of sizes between 16 cm. and 45 cm., or in other words salmon between the smolt stage and the grilse stage, were practically not to be found in those waters in which our salmon fisheries were carried on, that is to say in the rivers and fjords and among the outer islands along the coast. What had generally been supposed to be immature salmon were really sea-trout. This I was able to prove by rearing small salmon in salt water until they attained the requisite sizes, when they were found to be different from fish which had previously been considered immature salmon, and further confirmation of this was obtained by catching and examining quantities of sea-trout and showing that there were no small salmon among them. I finally succeeded in ascertaining that immature salmon, in an earlier stage than grilse, are caught in the mackerel nets along our south coast far out at sea, and this discovery I have subsequently been able to confirm by further instances, of which I gave a brief description in 1906 "Nyere oplysninger om Unglaks og dens Opholdssteder," Norsk Fiskeritidende, 12te hefte, 1906.

As a result of these discoveries, when the new law with reference to salmon-fishing was passed in 1905, regulations were made exempting sea-trout fishing from certain restrictions, amongst others the obligation of a minimum mesh in non-stationary appliances (seines and gill nets). These restrictions had previously rendered such sea-trout fishing all but illegal everywhere, and had merely been imposed with the object of protecting the immature salmon that were supposed to constitute a portion of the catches made by this mode of fishing for sea-trout.

During the discussion on this law it was even proposed to do away with all restrictions as to size of mesh in the case of salmon also. However, it was eventually decided to adhere to the minimum size of mesh previously

prescribed, viz., 5·8 cm. The principal argument put forward for retaining this minimum size of mesh, or, indeed, any prescribed size, was that it would result in the protection of small grilse, or at least such grilse as it was thought better to spare, with a view to their becoming of greater benefit to the fisheries on their subsequent return from the sea as larger fish.

This argument carried with it so much weight that it became in my opinion a matter of the utmost importance to discover a suitable method of acquiring the fullest possible information on the questions of the salmon's age, and rate of growth, and as to its life history generally.

My previous investigations had also frequently brought me into contact with many problems relating to the marked tendency to variation shown by all the varieties and species of the Salmonidae, and especially to the remarkable disposition to variation possessed by all the numerous forms of trout. It has long been recognised that both salmon and trout may vary exceedingly in different localities, a difference which is often strikingly apparent in the size of the fish. For example, in the case of salmon it was well known, and it has also been proved by actual measurements, that along certain parts of the coast they were larger than at others, and, further, it was known that trout in certain lakes and streams attained considerable dimensions; whereas in other waters, perhaps in the immediate vicinity, they barely succeeded in passing the limit at which they became sufficiently large for eating.

This remarkable and long-recognised tendency to variation on the part of the fishes of the salmon species was accounted for, in various ways, by different investigators.

As I have shown at length in my introduction to "Ørret og Unglaks," Linnæus, when composing his "Systema Naturæ" was evidently impressed by this tendency towards variation, and endeavoured to draw up a classification of the separate species of the salmon family, (salmon, sea-trout, burn-trout, mountain-trout, lake-trout, etc.) while later investigators, inspired by the same idea, have endeavoured to establish the existence of even a greater number of separate species. This practice was in fact carried so far, that actually the young of the ordinary salmon were described, and for a long time were known as an independent species (*Salmo salmulus*).

However, the employment of a larger amount of material for the study of the species resulted in a perhaps rather exaggerated disposition to reduce their number, and the leading men of science at the end of last century, notably the two Swedes, Smitt and Liljeborg, reduced the whole family to merely two species, namely, salmon and trout. Smitt even looked upon the trout as merely a variety of one main species, the Salmon (*Salmo salar*). All varieties of salmon and trout were thus held to be sub-species of one or more main species.

Since that time opinions as to the causes in the variation in these species have chiefly followed two directions. According to one theory a number of local races exist, more or less widely distributed, and their peculiarities are based on the ordinary laws of selection and heredity. The other theory lays greater stress on the question of food supply. The assertion has been put forward that peculiarities in shape and colour may easily be explained as being merely due to environment. The variation in size, which is undoubtedly the most striking and characteristic dissimilarity is explained as being due to different conditions of food supply. Others again are of opinion that these variations are due to both race and environment.

For a fuller understanding of the subject it is absolutely necessary that one should be able to determine the age and rate of growth of the different fishes in their natural state in different localities, and it was for this reason that I considered it advisable to investigate the matter fully with a view to the classification of salmon and trout according to their age.

The works published since 1899 by Hoffbauer, Reibisch, Heincke, and Stuart Thompson seemed to show that a classification of this kind was feasible in the case of carp, plaice, and several of the gadidae. In some cases by means of the scales and in others by investigating the bones it was demonstrated that there existed periodic forms of growth in summer and in winter, and that this difference was indicated by annual growth-rings in these parts, similar to the rings found in trees.

Investigations into this question were inaugurated in 1904 under the supervision of Dr. Hjort at the Norwegian Fishery Institute, and Dr. Damas, and I devoted special attention to the age of the gadidae, first by studying their otoliths, and afterwards by examining their scales, which were found to lend themselves admirably to the purpose. Subsequently we extended these researches to many other species of fish, amongst others both sprats and herrings, and the results obtained have been most satisfactory. A summarised account of the history and literature of this work has been published by me in the "Internationale Revue der Gesammten Hydrobiologie and Hydrographie," Bd. 11, 1909, under the title of "The Assessment of Age and Growth in Fish."

The success attending our efforts led me in 1905 to extend my investigations to the scales of trout and salmon which showed a distinct annual ring formation. I was induced to proceed further with my investigations by the publication in the same year of the first published work on salmon scales, and which appeared as a contribution from Mr. H. W. Johnston in the "23rd Annual Report of the Fishery Board for Scotland."

From the University, to which I applied for support in carrying out systematic investigations, I received a grant during the years 1906 and

1907, which enabled me to obtain material sufficient to demonstrate that very important results might be obtained by collecting material on a larger scale, and more fully investigating the age and growth of the salmon stock in Norway.

In the autumn of 1907 I was requested by the Agricultural Department to submit a scheme for such investigations, and, in accordance with my proposals, the necessary funds have been annually placed at my disposal by the Storthing.

In order to obtain material for investigation which would fully represent the salmon which are caught in our various fisheries in Norway, I selected three different parts of the coast, namely the Christiansand district, the Trondhjem district, and East Finmarken. Thanks to the courtesy of Herr Tobias Tobiassen of Christiansand and of Messrs. M. Thams & Co., Trondhjem, I have been able to collect examples of scales from the different ice-houses during the salmon-fishing season, either from the whole catch dealt with at the ice-houses, or from as many fish each day as it was possible to arrange for. These gentlemen have also very kindly allowed me access to their books, thus enabling me to obtain very valuable statistics throwing light on the representative value of the samples collected. I have further obtained from various other localities, partly through the kindness of private individuals and partly thanks to the assistance of fishery officials, samples of material throwing light on different side-issues, and I have also collected during my travels considerable numbers of samples of parr and smolts from the different rivers.

With the progress of my studies on the salmon's age it became increasingly evident that it was necessary and desirable to attempt at the same time a careful investigation into the age and growth of the trout and its many varieties. With this object in view I collected examples of trout and sea-trout scales from a number of localities ranging from Finmarken to the southernmost parts of Norway. Most of them I collected personally, though many private individuals interested in the subject gave me valuable assistance.

From abroad and especially from Great Britain, I received much valuable help. Mr. Calderwood, the Fishery Inspector for Scotland, rendered me assistance on several occasions, and Dr. Holt was kind enough to send me over from Dublin a large sample of Irish salmon scales. Mr. J. Arthur Hutton of Manchester also gave me invaluable assistance. His splendid micro-photographs of salmon scales are already known from his excellent papers on the subject, and he has now done me the favour of placing his technical experience at my disposal, and has kindly executed all the micro-photographs of scales from which the illustrations in this work are taken. I am also largely indebted to this gentleman for arranging and kindly supervising the English edition of the present paper.

For comparison with our own fish I obtained from Denmark and Bavaria examples of trout, some captured in their wild state and others artificially reared. Some of these I collected myself in the course of a short journey during the autumn of 1909, and the rest were sent to me later. In this connection I have to thank Herr Smidt-Nissen of Ejstrup, Herr Pedersen of Vamdrup, the Bavarian Fishery Association, and Dr. Plehm of the Royal Bavarian Fishery Experimental Station in Munich, who was kind enough to collect samples for me.

I likewise collected during my travels a few small samples of char and grayling for purposes of comparison.

As regards the collection of material, I desire further to state that each fish was as a rule weighed and measured, and where possible the sexual organs were also examined. The data thus obtained were written down on an envelope in the case of every fish, and a sample of its scales was scraped off and placed inside the envelope in which they were dried. The sample of scales was taken whenever possible, from above the lateral line and a little behind a perpendicular line drawn from the posterior edge of the dorsal fin.

The length of salmon was always measured by taking a line from the tip of the upper or lower jaw to the end of the median ray of the caudal fin. This method of measurement was adopted so as to accord with the previous measurements of salmon taken in Norway.

In the case of trout and other fish it was found necessary for various reasons to measure the length from the tip of the snout (upper or lower jaw) to a perpendicular line drawn between the flukes of the caudal fin when spread out naturally, that is to say I employed the method adopted by Heincke for measuring herrings which has since come into general use in the International Ocean Researches for measuring all fish with forked tails.

What follows has been arranged in such a manner that all important determinations of length and weight in relation to size and age are set down in tabular form in the Appendix. I shall begin by discussing the method employed and its possibilities, and then, by a comparison of the data contained in the tables, endeavour to elucidate the various problems connected with the age, growth, and general life-history of the different fish, in so far as these are affected by the knowledge obtained from the methods adopted.

KNUT DAHL.

BERGEN, 23*rd May*, 1910.

THE AGE AND GROWTH OF SALMON AND TROUT IN NORWAY.

CHAPTER I.

METHODS OF INVESTIGATION.

1. The Scales of Salmon.

The use of Salmon Scales as a means to the study of the age and other biological conditions of the fish is due, so far as I can ascertain, to Mr. H. W. Johnston. In three papers published in the Annual Reports of the Scottish Fishery Board for 1904, 1906, and 1907, he has succeeded in establishing the fact that periodic growth takes place in the scales of salmon, and that groups of rings are formed in each year, and that it is possible by counting the number of these to ascertain the age of nearly every individual, and to form an opinion regarding its life history. In the first article he relied mainly on scales taken from fish caught at various seasons of the year, and he succeeded in demonstrating by the study of these scales that various growth zones in the scales were formed in different periods of the year. In his later papers he was able to throw additional light on the subject from the investigation of scales of marked fish, and of fish whose age was known. Mr. Johnston further made it clear that the scales of mature fish, which had returned to the river from the sea, were affected to a most remarkable extent by their sojourn in fresh water. When these fish returned to the sea after spawning and new growth was developed, the consequences of their stay in the river were shown by a permanent and ineffaceable scar on each scale, which Mr. Johnston termed the "Spawning Mark." His investigations have been supplemented and popularised by other English writers, notably Mr. Calderwood and Mr. Hutton.*

In view of what had already been definitely proved, I decided to restrict my investigations towards ascertaining whether the same conditions applied also to Norwegian salmon, and also if possible to supply methods of investigation which might lend themselves to statistical analysis.

* The latter author has also recently made a special study of salmon from the River Wye in England.

The points on which I thought it important to obtain further information were the following:—

1. The growth of the scales of salmon-parr and smolts prior to migration.

2. The first growth of the scales in the sea.

3. The formation of the annual rings in relation to the seasons of the year.

4. The question whether all spawning fish were so affected by their stay in the river, that a "spawning mark" would invariably be found on the scales of every salmon which had spawned.

For the sake of those readers who may not have access to the publications mentioned, I will endeavour, even at the risk of repeating what may have been previously published elsewhere, to describe the structure of the scales as found by me in my investigations on Norwegian salmon.

(a.) *Scales of Parr and Smolts prior to migration.*

If we examine the scale of a smolt or parr under the microscope we see at once that it consists of a transparent plate of an irregular elliptical shape, and that the under surface is smooth. The anterior portion, which is embedded in a pocket or fold of the skin, is characterised on the outer surface by a series of concentric elliptical rings, which are parallel with the outer edge of the scale. On the posterior or exposed portion of the scale, and which is the only portion that is visible before the removal of the adjacent and overlapping scales, these concentric lines or rings become, and especially with increasing age, most irregular and indistinct.

A good illustration of the formation and growth of the scales during the first summer of the parr's life was obtained from a number of specimens reared in 1898 in the State Hatchery at Haugsund, in Eker. I give below the results of the examination of six selected individuals, ten to twenty scales being examined in each case:—

Length in cm.	Date Killed.	Number of Rings.		Average.
		Minimum.	Maximum.	
3	1/6	1	1	1*
3·5	1/7	2	5	4·2
4·5	1/8	4	6	4·8
5·5	1/9	4	8	6·2
6	1/10	6	8	7·4
10	1/11	12	19	16

* The scale consisted of a very small plate, the edge of which may be regarded as identical with the first ring.

These parr were hatched in March, 1898, and killed during the course of the summer.

From this we see clearly that the formation of rings advances with the growth of the parr during the course of the summer, and that the scales develop with the growth of the fish.

The accompanying figure (Fig. 1) illustrates the scale of the largest parr. If we examine it closely we note that all the inner growth rings go regularly, and practically without a break, around the whole of the scale. It is not until we come to the three outer rings that we find that the ring formation begins to be broken. These latter rings are only perfect on the anterior portion of the scale (the upper portion of the figure), and elsewhere they are merged in the edge of the scale. It should not be forgotten that this fish was killed in the late autumn.

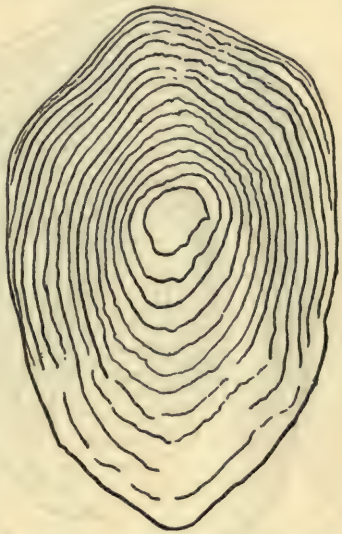


FIG. 1.—Parr 10 cm. Hatched March, 1898. Killed November 1, 1898 (magnified).

As a rule rings formed in the summer are unbroken around the circumference of the whole of the scale, though occasionally one may meet with scales of which the summer rings are not always complete. This probably arises from the fact that all growths do not proceed simultaneously, and that therefore the different portions of the scale have not always the same uniform rate of growth. It is more than likely that this is due to some variation in rate of growth in length and in girth. In autumn and winter the growth generally decreases or ceases entirely, and all the scales I have seen show a similar edge to the one illustrated. This character is also retained during the whole of the winter, and such little growth as does take place is shown in the production of narrower rings close to the edge of the scale. After the winter, when development begins again, the ring formation of the new season does not entirely coincide with the last formed rings of the preceding season, and the new growth is shown by the formation again of entire and unbroken rings. It is therefore as a rule easy to recognise the winter rings formed during the period of stagnation between the two growth-zones. The chief characteristics of this period of stagnation are the pronounced branching or ramification of the rings, and also the fact that they are narrower and lie closer together, so that a magnified representation of a scale shows a narrow and more darkly shaded belt. This narrow winter-band has also a different optical refractive

power, as will be seen with a microscope by using different methods of illumination.

This difference in the appearance of the summer and winter growth on the scales can be easily seen by examining them at different seasons of the year, but I considered it advisable to investigate the scales of parr of known age.

From the State Hatchery at Haugsund I obtained examples of parr hatched in April, 1907, reared there and finally killed in the middle of

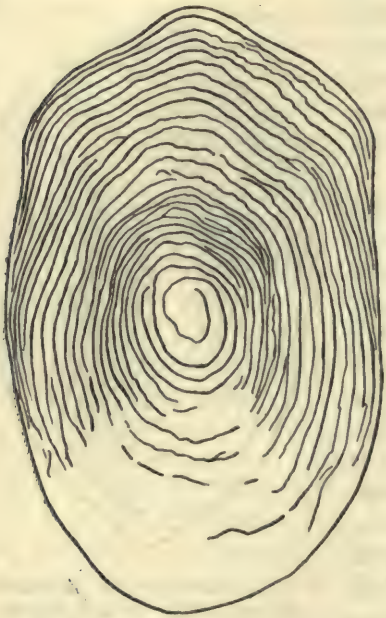


FIG. 2.—Parr 13 cm. Haugsund. Hatched April, 1907. Killed middle of December, 1908 (magnified).

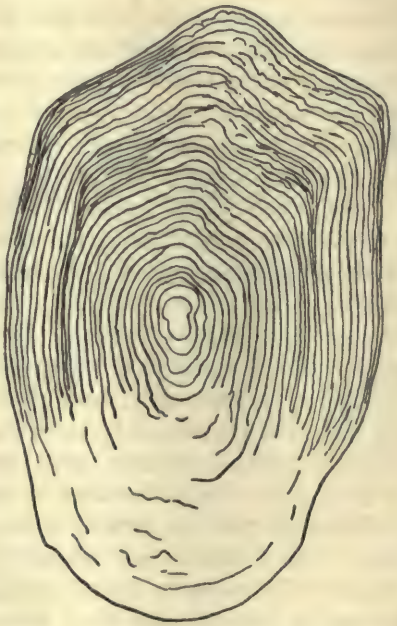


FIG. 3.—Parr 13 cm. Haugsund. Hatched April, 1907. Killed middle of December, 1908 (magnified).

December, 1908. These fish had, therefore, lived for two summers and a portion of the second winter. The accompanying figures (Figs. 2 and 3) show the scales of two of them. It will be seen that the structure of the scales corresponds fully with the seasons during which the fish have lived. In the centre of each we find a growth-zone, consisting of relatively unbroken broad rings corresponding to the first summer. Surrounding this we find a band of narrow branching rings depicting the slackened rate of growth during the first winter. Then again surrounding this inner core we find similar growth-zones corresponding with the second summer and half of

the second winter, and which show a repetition of the characteristics of the first year's growth. I examined altogether ten of these parr, and the scales of all showed growth-zones and winter-bands similar to those illustrated.

Further in the examples I have examined of parr and smolts which have grown under natural conditions, and which were caught in spring, summer, and autumn, I have found no difficulty in distinguishing the appearance of the scales at the various seasons of the year.

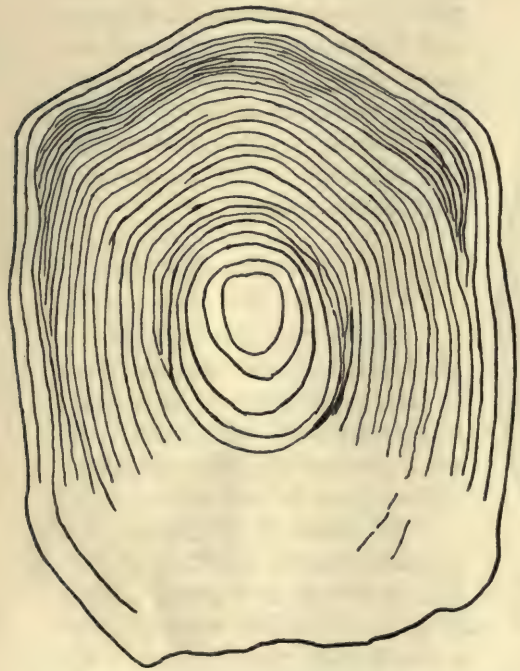


FIG. 4.—Parr 12 cm. Softeland May 25, 1909 (magnified).



FIG. 5.—Parr 10 cm. Softeland June 11, 1908 (magnified).

The three next illustrations (Figs. 4, 5, and 6) depict the scales of parr caught in the Softeland River in the Os district, in May, June, and October. They show clearly how the summer's growth is indicated on the scales. For example, in Fig. 4 we see that the winter-band, formed during the second year of the parr's existence, lies close to the edge of the scale and that only two new broad rings, denoting summer growth, had been formed. The June scale (Fig. 5) shows that these broad summer rings have increased in number, whereas the October example (Fig. 6) clearly indicates the fact that the formation of broad summer rings had ceased, and the narrow branching

winter rings are present, showing the commencement of the third winter of the fish's life.

The beginning and the duration of winter naturally vary in different rivers and districts, and consequently there will be considerable variation in the formation of the broad rings indicating summer growth. It seemed to me for the present to be unnecessary to devote much valuable time to the investigation of fish from numerous localities in order to establish this fact. What I considered of more importance, as I have endeavoured briefly to prove, was that the growth of the parr is very different in summer and winter, and that the seasons leave ineffaceable marks on the scales, which consequently enabled one to state the number of winters and summers which the fish has spent in the river.



FIG. 6.—Parr 12 cm. Softeland middle of October, 1908 (magnified).

(b.) *The Scale after Migration to the Sea.*

When the parr becomes a smolt and migrates from the river to salt water it meets with absolutely different conditions. In what manner are these conditions indicated on the scales?

In order to illustrate this question I give a drawing of portion of a scale of a young salmon (Fig. 7). This fish was caught as a smolt with many others at the mouth of the Gula River at the end of June, 1900. It was then between 10 cm. and 15 cm. long. Together with others it was placed in a large salt water tank at the Trondhjem Biological Station, and kept there until October 18, 1901. When it was killed it was 29·5 cm. in length.

Naturally the surroundings one could give it were not so favourable as it would have obtained in the sea, but in spite of this it had grown much more rapidly than any parr living at liberty in fresh water would have done. In the portion of its scale shown in Fig. 7 we clearly see the three winter-bands denoting its life in the river as a parr. Immediately after the completion of the third winter the fish was placed in the aquarium, and the

rapid growth which then ensued is clearly depicted in broad and strongly marked growth rings formed during the first summer in salt water. Surrounding these is a band of narrow branching rings corresponding to the winter spent in the aquarium, during which period the fish took only very little food. Finally we find a wide belt of broad, well-marked rings, corresponding to the growth during the second summer in the aquarium. It is evident, therefore, that the rings on the scale correspond exactly with the conditions under which I knew the fish had lived from the moment when it first came into my hands.

That the growth of the fish referred to above and also of the other small salmon reared at Trondhjem was considerably less than would have taken place under natural conditions is a fact of which I have been aware for some considerable time, but more especially so now that Mr. Johnston's investigations have been published.

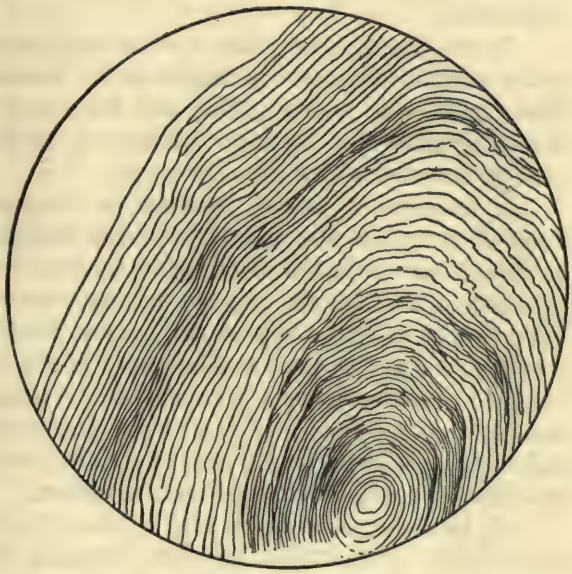


FIG. 7.—Grilse 29·5 cm. ♂ unripe. Reared in a Salt Water Aquarium from June, 1900, to October 18, 1901 (magnified).

To put the case briefly, he discovered that grilse from 45 cm. and upwards in length and weighing a kilogram or more had spent only one winter in the sea, whereas larger salmon had spent two or three, or in exceptional cases four winters in salt water, and also that the annual winter bands were as a rule clearly shown. In addition to the investigations which he had carried on for several years, he obtained further confirmation of his conclusions from the well-known marking experiments which were carried out on the River Tay in Scotland. Several thousand smolts were marked when migrating in the spring of 1905 by means of fine silver wire placed in the dorsal fin.*

A number of these fish were recaptured, and on examination of their scales he was able to establish the fact that the structure and markings

* Cf. W. L. Calderwood, "The Life of the Salmon," Chapter 11.

corresponded exactly with the known life of the fish. Those recaptured as grilse in 1906 had two summer-zones and one winter-band formed subsequently to migration, whereas the scales from fish recaught in 1907 had two summer-zones and two winter-bands when caught in the spring, and an additional summer-zone when caught later on in the year.

I have found identical summer-zones and winter-bands on the scales of Norwegian salmon, and I have also discovered that according to the size of the fish they may show from one to four winter-bands subsequent to migration.

It was therefore of great interest to investigate the scales of the small grilse which are frequently caught in the mackerel nets in the Skagerack. These fish varied in size in May and June from 36 cm. to about 45 cm., and the scales show that all these fish have spent one summer, one winter, and part of a second summer in salt water.

It was even of greater interest to discover salmon in a less advanced stage of growth in the Sandeid Fjord in Ryfylke, and which were sent me by Herr Landmark, the inspector of fisheries. The examples sent consisted of nineteen individuals, varying in length between 22 cm. and 27 cm., and were caught between July 28 and August 28 in 1908. Their scales showed markings similar to the one illustrated in Fig. 8 (Plate I.), which was photographed from the scale of a fish 26 cm. in length. In the centre is clearly shown the poor growth made in the river prior to migration, but surrounding this we find a zone of wide and well-marked rings, without any branching or contraction in their formation.

If, however, we compare Fig. 9 (Plate II.), which represents the scale of an ordinary grilse 57 cm. long and weighing 1·9 kilos, we find that it has two summer zones and one winter band subsequent to migration. Further, if we compare Fig. 10 (Plate III.), which is similarly reproduced from the scale of a salmon 76 cm. in length and 4·3 kilos. in weight, we find two winter-bands and three summer-zones after migration. Fig. 11 (Plate IV.) represents the scale of a salmon of 10·5 kilos. and 96 cm. long, and here we find after migration three summer-zones, three winter-bands and the commencement of a fourth summer-zone at the edge of the scale. Finally, in Fig. 12 (Plate I.), which depicts the scale of one of the largest salmon I have been able to get hold of, we find surrounding the central portion of the scale, which indicates the life of the fish up to the smolt stage, four, and possibly five, winter-bands with the corresponding summer-zones. Now if we compare Figs. 9, 10, and 11 we easily perceive that in 9, which was caught on July 8, in the Topdalsfjord, the winter-band is some distance from the edge of the scale, whereas in 10, which was caught in the same place, but on May 27, the last winter-band lies much closer to the edge. In 11, which was caught on June 9 in Finmarken, where summer begins

much later, the last winter-band i quite close to the edge of the scale. We also find the same to be the case in the scales of the large fish (Fig. 12) caught in the month of May. It is therefore evident that in Norway also the ring formation at the edge of the scale corresponds to the period of the year when the fish was caught. After examination and analysis of the scales of several thousand salmon, I find that in the majority of the large fish caught at the beginning of the season the last complete winter-band lies close to the edge of the scale, whereas in small fish caught at a later period the summer-zone outside the previous winter-band is always broader and contains a greater number of rings.

This fact is further illustrated by the following table, which contains an analysis of the various positions of the last winter-band in relation to the edge of the scale, and is based on the examination of 262 salmon caught along the Mandal coast from May to July, 1909. This analysis is based on an approximate estimate of the relative width of the summer-zone lying between the last completed winter-band and the edge of the scale, and must therefore not be taken as absolutely accurate. It clearly indicates, however, that the formation and growth of the summer-zone takes place during the summer months, and that this zone increases in width as the season advances. It also shows that in a number of fish caught in May, and even in June, the winter-band lies close to or is actually on the outer edge of the scales.

ANALYSIS OF THE SCALES OF 262 SALMON FROM THE COAST NEAR MANDAL.

Month.	Number of Salmon Examined.	Number and Percentage of Scales on which the Last Winter-band was Situated.			
		On the edge.	Near the edge.	Some distance from the edge.	Far from the edge.
End of May . .	22	2 (9%)	11 (50%)	5 (23%)	4 (18%)
First half of June .	63	1 (2%)	18 (29%)	32 (51%)	12 (18%)
Last half of June .	84	—	4 (5%)	20 (23%)	60 (72%)
First half of July .	93	—	—	11 (12%)	82 (88%)

It is most exceptional for any salmon to be caught in the sea in Norway during the winter months, and it was therefore impossible to obtain material in order to ascertain the appearance of the scales during the winter season. I therefore requested Dr. Holt to send me from Dublin the scales of a number of salmon caught in Ireland during the early spring and summer of 1909. This material has been examined and analysed as above in order to ascertain the position of the last winter-band. The results are given in the following table:—

NUMBER AND PERCENTAGE OF SCALES ON WHICH THE LAST WINTER-BAND WAS SITUATED.

Month.	Number of Salmon Examined.	On the edge.	Near the edge.	Some distance from the edge.	Far from the edge.
January . . .	3	3 (100%)			
February . . .	11	11 (100%)			
March . . .	20	20 (100%)			
April	20	15 (75%)	3 (15%)	2 (10%)	
May	12	2 (17%)	4 (33%)	6 (50%)	
June	8	1 (12%)	1 (13%)	6 (75%)	
July	6	—	1 (16%)	2 (34%)	3 (50%)

Here we find that the last winter-band lies close to the edge of the scale throughout January, February, and March, and it is not until April that a few fish begin to show the commencement of summer growth at the edge of the scales. In May, June, and July the summer-zone becomes larger and larger, in exactly the same manner as we found to be the case with Norwegian fish.

In my opinion these investigations have made it pretty clear that the narrow, close-lying, branching rings are in fact winter-zones, whereas the summer-zones are formed of broad, boldly-marked and less branching rings which lie further apart. At any rate, the formation of these two different series of growth-rings or zones takes place in the winter or summer half of the year respectively.

If one examines Figs. 9 to 11 (Plates II., III., IV.) it will be evident that one can easily and unmistakably distinguish the different annual rings at a glance. This is, however, not always the case, and a certain amount of practice is required if this method of examination is to be employed for statistical purposes. In addition, it is necessary that any analysis made should be based on as large an amount of material as possible, so that in doubtful cases one can obtain assistance from the bulk of the specimens examined, and also render the few errors of analysis which may arise of little importance by the overwhelming weight of the quantity examined.

One of the chief difficulties and especially to beginners, is the fact that scales may sometimes become slightly displaced in the process of growth, and consequently present a distorted picture of the subsequent growth in relation to what has previously taken place. In the next place there may occur with some individuals secondary checks in the ring formation during summer growth, and which are indicated by two or three rings or more

being contracted and closer together. These contractions may be due to checks or irregularities in the whole growth of the fish, or to variations in the relative rate of growth in length or girth. It is easy to understand that a fish which grows so rapidly and which consequently requires such an enormous amount of food is very soon affected by any period of scarcity, and it is evident that any such check in growth will be more or less clearly indicated on the scales. In the same way a transition from rapid growth in girth or thickness to a state of growth relatively more pronounced in length would manifest itself by a narrowing of the growth rings at the sides, and also in the front portion of the scales. These narrowings or contractions in the ring formation which appear in the summer-zone are, however, much less distinct than the winter-band, and one soon learns how to distinguish one from the other with certainty. That they are in no way connected with the winter is evident from the appearance of the scales from marked fish of known age, which were examined and depicted by Johnston.*

In order to ascertain more fully the significance of these secondary checks, I made an analysis of the frequency of their occurrence in a large number of salmon caught in the summer of 1909 in the neighbourhood of Randøsund and Flekkerø (Christiansand). Out of these I picked out only those fish which had one winter-band subsequent to migration. In the following table I have divided them into two classes, those with and those without the secondary check (see next page).

It will be seen that the fish whose scales show this secondary check are of exactly the same average length as those without it. This could not possibly have happened if this secondary contraction of the rings gave the same indications as to age as shown by the winter-band.

There is yet another difficulty which should be mentioned, as it is likely to cause considerable trouble to the inexperienced. In scales taken from nearly every fish one will find a greater or less number absolutely different from the others. Such scales have this remarkable feature that the structure of the growth-rings and the season-zones can be easily traced from the outer edge of the scale for a greater or less distance inwards towards the centre, and as far as this portion of such scale is concerned they are exactly like other typical scales taken from the same fish. There is, however, this difference, that at a greater or less distance from the outer edge of the scale all regular ring-formation disappears, and the central portion of the scale, which will be of varying extent as the case may be, consists of a large clear space consisting of a number of irregular stripes

* "Twenty-sixth Annual Report of the Fishery Board for Scotland (for 1907)," H. W. Johnston. The Scales of Salmon, Figs. 1 and 2.

Analysis of 75 Salmon from Flekkerø and Randøsund, 1909.

Length in cm.	Number of Fish without the Check.	Number of Fish with the Check.
47	1	—
48	—	—
49	—	—
50	2	2
51	3	—
52	2	2
53	9	5
54	10	6
55	7	6
56	2	2
57	2	—
58	3	1
59	1	1
60	2	1
61	1	1
62	2	1
Total	47	28
Average Length	54·7 cm.	54·7 cm.

and rings. Up to the present these scales have received but little attention, and they have generally been depicted and described as scales with "expanded growth centres." As a matter of fact they are scales which have been formed in place of those which have been lost.* As has been previously pointed out, the growth rings are formed only on the outer edge of the scale and on the outer surface. It is therefore evident that when a scale is torn off or lost rapid growth of an indeterminate nature takes place, and fills up the original scale pocket which acts as a matrix, and afterwards the formation of the ordinary ring-growth takes place around the circumference of this inner plate of indeterminate growth. From that time onwards the ordinary ring-growth proceeds in like manner to that which is being simultaneously added to the other scales. At the same time the scale pocket or matrix of every scale on the fish is simultaneously increasing in size. It will be evident that this is the case if we examine a scale, the central portion of which has at some period of the fish's life been displaced without being actually lost. The accompanying drawing (Fig. 13) shows an example of this.

The illustration shows the central portion of the scale of a full-grown

* Attention was drawn to this point by Mr. Hutton in his last paper.

salmon. We see the two years comparative poor growth in fresh water, and surrounding the second winter-band a few of the broad rings are shown which were formed in the richer feeding ground of the sea during the first summer after migration. Shortly before the innermost winter growth was completed, during the first year of life in fresh water, the scale must have been pushed backwards and sideways, and thus displaced from its original position. The posterior edge of the scale has been worn away or re-absorbed, and has, as it were, adjusted itself to the shape of the original scale pocket or matrix. In that portion of the matrix left empty by the displacement



FIG. 13.—Salmon, 70 cm. long, 3·9 kilos. Mandal, June 29, 1909 (magnified).

of the scale we see that no regular ring-formation has taken place, but it has been filled up by growth of an undefined and indeterminate nature, corresponding to the blank space previously occupied by the anterior portion of the scale. Outside this growth ring-formation has proceeded in the normal manner. If the scale had been lost the whole of the space within the matrix would have been filled with indeterminate and abnormal growth.

The occurrence of such scales is not, however, of importance, provided that one is aware of their existence, and care is taken to select for examination only such scales as have perfect centres.

(c.) *The Scale after the Salmon's Return to the River and the Formation of the Spawning Mark.*

Johnston has clearly and unmistakably shown that the sojourn of the salmon in fresh water and the spawning which afterwards takes place may have a most remarkable effect on its scales. The scales of spawned or spent fish (kelts) which were examined by him were found, in consequence of river life and the act of spawning, to be much frayed or worn away, either because of the terrible emaciation of the fish or through partial re-absorption during the fasting which they undergo in fresh water. This wear and tear or re-absorption mainly affects the posterior and upper and lower portions of the scales. This is well shown in Fig. 17 (Plate VI.). Here we see that large portions of the posterior, as well as the upper and lower portions of the scale, are, as it were, eaten away, and to such an extent that the posterior portions of a number of the growth-rings are broken off. When the fish returns to the sea after spawning and feeding, and growth begins again, the new ring formation does not follow the line of the old ring formation, but is formed in the usual manner parallel with the outer edge of the broken scale, and in some cases one may find the new growth-rings running in a direction almost at right angles to the old ones. This is clearly shown in Fig. 18 (Plate VII.). In the gap between the broken edge of the kelt scale and the subsequent new growth, a scar is formed which is retained throughout the rest of the fish's life. If it again returns to the river and spawns for a second time, and again returns to the sea and further feeding takes place, we find a second scar or "spawning mark," as it has been termed by Johnston. A scale with two such spawning marks is shown in Fig. 19 (Plate VII.).

That this is the case has been fully demonstrated by Johnston from the examination of the scales of fish which were marked after spawning. Some of these marked fish were recaptured as clean fish, and the scales were sent to him for examination. In every instance an undoubted "spawning mark" was found on the scales, and he has thus established beyond all possible doubt the fact that the "spawning mark" is the result of spawning, and that when such a mark is found on the scales of any fish it affords unmistakable proof that the fish had previously spawned.

The number of fish examined by Johnston was, however, too small to make it absolutely certain that it was impossible for a fish to spawn without a scar or spawning mark being left on its scales, and until such proof had been obtained one could not form sound conclusions by statistical analysis of the proportion of previously spawned fish to the general stock in any river.

I therefore obtained the scales from a large number of salmon caught

in fresh water, and mainly from spawned fish, or those about to spawn. I then studied the appearance of the scales, and particularly as to the extent to which they were affected by the sojourn in the river and the act of spawning.

The edges of every scale taken from a clean well-fed fish caught in the sea, or just after entering the river, resembles the one shown in Fig. 9 (Plate II.). Such scales I have classified as "unworn." Those which on examination showed that they were affected by sojourn in fresh water have been divided into four classes, viz., "slightly," "moderately," "much," and "excessively worn." These various stages are illustrated in Figs. 14, 15, 16 and 17 (Plates V. and VI.). The following table gives the results of these investigations:—

	Place and Year.	Month.	Number Examined.	Condition of the Wear of the Scales.				
				Unworn.	Slightly.	Moderately.	Much.	Excessively.
Before the Spawning Season	Skogan-varre, Laks-elv, 1909	July	12	7	4	1	—	—
		August	4	—	—	3	1	—
		September	2	—	—	—	2	—
Spawning Fish	Lærdal River, 1909	October	35 ♂	—	—	1	9	25
			70 ♀	—	18	23	20	9
	Etne River, 1907	November	11	—	1	3	4	3
	Drammen River, 1909	December	15 ♂	—	—	—	—	15
			10 ♀	—	—	—	6	4

An examination of this table reveals the following facts:—

In the fish examined in the summer prior to the spawning season (see the examples from Skoganvarre) the scales are found to be more and more "worn" as the autumn approaches, On the other hand, of the fish examined during the spawning season (the examples were taken from parent fish used for artificial hatching) not one single individual has scales which are unaffected. The extent to which the scales are worn is considerably larger with the male fish than with females, and it is also more noticeable during the later months of the year. It is probable, therefore, that the wearing of the scales would be even more advanced by the time the spent fish left the river as kelts and again returned to salt water and regained

suitable conditions of nourishment. It is, however, the fact that not a single salmon had its scales unaffected by its stay in the river and the act of spawning, and therefore, of all the fish examined every single one would throughout its future existence show on its scales absolute indications of having spawned.

I consider it therefore as absolutely proved that practically every single fish which survives the act of spawning, and again regains the feeding grounds of the sea, will possess a "spawning mark," and it equally follows that the occurrence or non-occurrence of this mark may be utilised as a fairly certain indication as to whether a fish has previously spawned or not.

2. The Scales of Trout.

The scales of all varieties of trout show a very close resemblance to the structural conditions and peculiarities previously described in relation to the scales of their near relation, the salmon. I will therefore avoid any lengthy description, but will briefly mention a few of the main points which are of importance for the investigation of trout scales.

The formation of the scale begins about midsummer, in the first year of its life, and, as is the case with salmon by the formation of a minute plate. As this plate increases in size concentric growth-rings are formed around the edge in the same manner as with salmon.

Some examples of young trout caught in August, 1907, in a Nordland stream, showed the following maximum number of growth-rings on the scales:—

Of 2 individuals, 3·2—3·3 cm., 1 ring (small plates).
1 „ 3·5 cm., up to 2 rings.
1 „ 3·5 cm., „ 3 „
4 „ 3·7, 3·8, 3·8, 3·9 cm., up to 4 rings.
1 „ 3·8 cm., up to 5 rings.
1 „ 4·0 cm., „ 6 „

In summer the rings are farther apart, and in winter closer together, and more branched, and similar to what was described in connection with salmon.

We can prove this by examining scales from fish caught at different seasons of the year, and also by studying artificially-reared fish of known age. I have examined several examples of artificially-reared fish, and have found that the markings on their scales correspond exactly with the seasons during which the fish have lived. As an example I have given two illustrations of the scales of these fish (Figs. 20 and 21).

When we compare the growth-zones and the consequent age of the fish as shown by the scales, we find that in each case this is in complete agreement with the known life of each individual.

It is therefore quite clear that the summer-zones and winter-bands on the scales of trout are respectively formed in the corresponding seasons, which affect their growth, and that these zones indicate annual epochs in the life of the fish. If, therefore, we count the number of these zones, we can ascertain the age of the fish. A more lengthy explanation is, I think, unnecessary, but I would merely refer my readers to the more detailed account previously given in connection with salmon.

As the trout scale is, relatively to the fish's size, smaller than that of the salmon, and as the majority of trout are small fish, it is evident that in most cases their scales are very small. This renders it difficult at first to count the number of winter-bands, especially when we are dealing with small fish of considerable age. However, a certain amount of practice enables one to do this accurately. An Abbe drawing attachment is of very great assistance, for with it one can project the enlarged image of the scale on to the table by the side of the microscope. If we place a strip of thin cardboard with its left bottom corner in the centre of the image, we can mark on its edge with a pencil the exact situation of each winter-band, and we shall find that by this method counting is both easier and more accurate. Most of my countings have been done in this way.

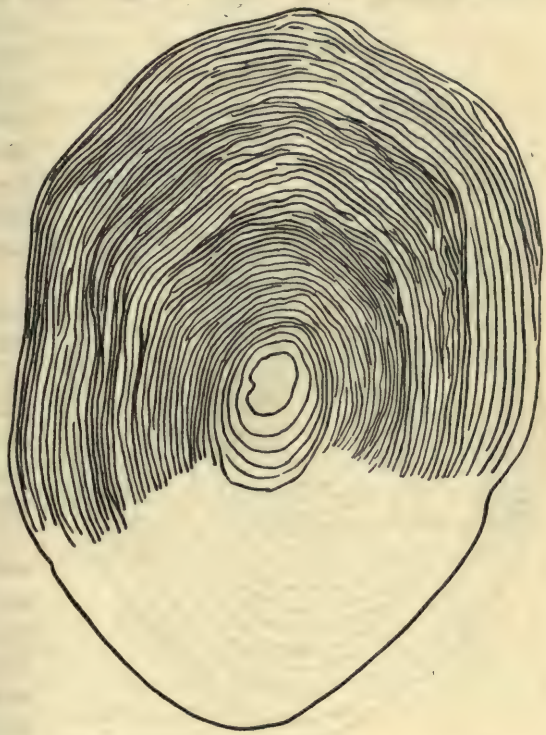


FIG. 20.—Trout 21·5 cm. Biological Station, Bergen. Kept three winters after hatching. Killed March 1, 1907 (magnified).

In the case of fish which have attained a relatively great age, it may happen that the determination of the bands near the edge of the scales may be exceedingly difficult. Frequently in such cases the edges of the scales have become thickened, and may be seen to contain several bands, without, however, one's being able to ascertain their number. In cases like these it

is naturally quite out of the question to determine the age beyond a certain number of years.

When one examines the scale of a salmon one notices at once that on migration to the richer feeding grounds of the sea a great change takes place in the conditions of growth. The slow-growing scale of the migrating smolt appears in the centre of the larger scale of the mature fish, like a small island of narrow growth-rings surrounded by the wider and boldly-marked rings which are formed in salt water. We can therefore easily distinguish the boundary line on each scale indicating the transition to other conditions of nourishment.



FIG. 21.—Trout from Starnberg Bavaria. Hatched in spring of 1908. Killed October 1909 (magnified).

With trout, on the other hand, which have spent all their life under uniform conditions, as, for instance, typical burn trout, we find the poor growth of the scales continued from the early stages up to a considerable age.

Other trout, however, whose early life has been spent under unfavourable food conditions and which at a later stage of life may have entered into more favourable environment, show on their scales a sudden transition and a consequent increase in the width of the growth rings, and this is similar in character to what we have observed in the transition stage of salmon. These characteristics we find on the scales of sea trout and also of trout from a number of lakes, about which I will later give fuller particulars. No trout, however, even under the most favourable conditions, as we shall see later, ever grows so fast as a salmon, and consequently the best growth-zones found on trout scales are never as broad or as well marked as those of salmon. Still, in the majority of cases the differences between unfavourable and favourable environment are clearly indicated on the scales, and therefore, as a rule, we can determine the period when the transition from slow to more rapid growth took place. As an instance of this I would

refer the reader to the characteristic scales depicted in Figs. 22 and 23 (Plate VIII.).

The spawning mark, which in the case of salmon we found to be a result of and also a clear indication of spawning, sometimes occurs also in the case of trout, but its appearance is generally of a different character. In salmon it is the result of the excessive emaciation which this large and rapidly-growing fish experiences owing to the terrible fasting and privations connected with a sojourn of many months in fresh water prior to and after spawning. Most trout spawn amidst surroundings and food conditions similar to those to which they are accustomed, and their spawning journey, as a rule, is short and unaccompanied by serious privations. Consequently, in most of the smaller forms of trout we find no spawning marks on the scales, even though the fish are of considerable age and have spawned on many occasions. On the other hand, we sometimes find one or more spawning marks on the scales of trout, whose growth has been considerable as compared with the food conditions which prevail in those surroundings where the spawning grounds are situated, and whose spawning journey is long and arduous. As an instance of this we may mention large sea trout and also very large lake trout, such as are found in the Mjøsen Lake and also in the lakes of Bavaria. Such spawning marks, however, of which an illustration is given in Fig. 24 (Plate IX.), as far as I can ascertain, do not always appear on the scales as a matter of course as is the case with salmon, and, in my opinion, cannot be depended on as reliable evidence of the frequency of spawning.

In investigations as to the age of fish and especially with reference to estimates of the rapidity of growth, great care is needed when such spawning marks are found ; and, further, if they are difficult to read one must endeavour to avoid mistakes, which might easily creep into an analytical table if one's material were not handled in a critical manner.

3. General Observations on the Use of Scales as a Means of Determining the Growth of Fish.

If we wish to study the rate at which salmon or trout grow, it is necessary to investigate the ages of a sufficiently large number of fish and to divide them into year-classes according to length or weight. We then find that the various year-classes include fish varying very much in size, and, in order to get an idea of the general rate of growth, we must calculate the average size or weight for each year-class, and on these averages we can base an opinion of the rate of growth.

For this purpose a large amount of material is necessary, with a considerable amount of labour for its investigation. As will be seen later, the

statistical analyses which I have drawn up are based upon the investigation of a very large number of specimens of both salmon and trout.

The amount of data necessary in order to obtain reliable statistics largely depends on the number of divisions into which our material has to be separated in the course of our investigations.

In the case of salmon the material examined consisted of many hundreds of fish, and I consider it beyond doubt that the data obtained are sufficient in quantity to be of distinct statistical value.

So far as trout are concerned my material generally consisted of about 50 to 150 individuals from each locality, and in order to ascertain whether the quantity examined was sufficient in number to avoid error I compared the results of two separate examinations from specimens taken from the same locality, either simultaneously or in different years. The results are given in the following tables :—

(1) Analysis of Trout from the Mølnbugt River, Agdenes (Cf. Table XXIII.).

Date.	No. of fish.	Average length of the different year-classes in cm. Number of specimens in each average in ().					
		2nd.	3rd.	4th.	5th.	6th.	7th.
July 9, 1908	51	13·9 (29)	17·5 (10)	22·7 (5)	25·7 (3)	28·6 (3)	32 (1)
July 4, 1909	62	13·6 (13)	19·3 (39)	23·4 (5)	26·3 (3)	30·5 (2)	
Difference . .		0·3	1·8	0·7	0·6	1·9	

(2) Analysis of Trout from Krokaa near Brønnøy (Cf. Tables XXXIII., XXXIIIb.).

Date.	No. of fish.	Average length of the different year-classes in cm. Number of specimens in each average in ().					
		3rd.	4th.	5th.	6th.	7th.	8th.
July 21, 1907	79	12·5 (2)	14·5 (6)	17·2 (23)	18 (41)	21 (7)	
August 8, 1907	32	12·3 (3)	14 (7)	17·2 (11)	19·3 (7)	20·7 (3)	27 (1)
Difference . .		0·2	0·5	0	1·3	0·3	

The specimens in the third table were caught with nets at either end of the lake about 500 metres from the shore.

An examination of these figures shows that it is only in a few cases

(3) Analysis of Trout from Bergstøvand, Osvasdraget, in the Os District (Cf. Tables XXV., XXVI.).

Date.	No. of fish.	Average length of the different year-classes in cm. Number of specimens in each average in ().				
		2nd.	3rd.	4th.	5th.	6th.
May 10, 1909	132	7·2 (5)	13·3 (50)	16·9 (44)	21·7 (26)	24·9 (8)
May 19, 1909	155	9·5 (4)	13·9 (73)	17·7 (24)	20 (24)	22·8 (9)
Difference . .		2·3	0·6	0·8	1·7	2·1

that we find absolute agreement, and even then it may be merely due to coincidence. Whether the examples examined be fairly large or relatively small in number our tests invariably show some discrepancy in the average length of the different year-classes. For these discrepancies there may be various reasons. They may be due to actual variation in the size of the fish owing to the catches not having taken place at the same time or locality. They may be due to the difference in the number of specimens in each sample, or there may have been mistakes in measurement. These discrepancies, however, are, after all, only small, and the probable error to which one is exposed in basing growth determinations on samples of 50 to 150 individuals does not amount to more than 1 cm. in those year-classes which are represented by a few individuals, and in those classes which are better represented the error is less, and does not amount to more than 5 to 6 per cent. at most in the total length of the fish.

For exact determination of the rate of growth it is evident that a larger amount of material is necessary, but the comparisons above clearly show that the examination of even 50 individuals and upwards can furnish results which are quite useful in arriving at general conclusions as to the rate of growth in various localities.

I have, however, for various reasons, considered it advisable to ascertain whether the examination of even a smaller number of individuals might not provide equally serviceable results for the purposes of comparison. To a certain extent this question is of theoretic interest in considering generally variations in growth. It would be of immense practical utility if we could take a few fish from any lake and form a reliable opinion as to their growth and as to the usual course of growth in that particular lake. If this were possible it would naturally make it far easier to obtain a definite comparison of the various conditions of growth in different waters.

I must again insist on the fact that the scales are permanent structures,

and when once acquired are, except in the case of accident, retained throughout life.

It is therefore evident that the actual number of scales on a fish is constant, and practically remains the same however old the fish may be. As an example I may mention the fact that the number of scales on salmon or trout on any particular portion of the body (as, for instance, on a slanting line drawn from the posterior edge of the adipose fin to the lateral line) is always found to vary within fixed limits in the case of every single trout or salmon which may be examined irrespective of age.

It therefore follows that the scale increases in size with the growth of the fish, and that this increase is proportionate to the increased size of the fish.

Seeing therefore that the growth of the scale is proportionate to the growth of the fish, it should be possible to calculate how long a given fish was on the completion of each winter of its existence by taking measurements of the various growth-zones shown on the scales. Such measurements would have to be made on the anterior portion of the scale which grows in a regular manner and where the periods of winter and summer can be differentiated. The measurement should be taken first from the centre of growth to the anterior edge of the scale, then from the centre to the last completed winter-band, then from the centre to the winter before, and so on. On comparing the measurements thus obtained in relation to the total length of the fish when caught it should be possible to calculate the length it had on the completion of each winter-band.

I give below a description of the method which I have adopted, and which is practically the same as the one that has gradually been adopted at the Fishery Directors' Laboratory for similar investigations of the scales of other fish, principally herrings and sprats. The method and apparatus have been described in detail by Mr. E. Lea in the "Publications de Circonstances du Conseil International pour l'Exploration de la Mer." It is therefore unnecessary for me to give a full description, and I merely give the main outlines of the method of investigation adopted.

By means of the Abbe drawing apparatus an image of the scale is thrown on the table, the long axis of the scale being kept parallel with the right-hand side of the microscope, and care being taken that the image is always in the same line of orientation. A strip of thin cardboard about 3 cm. broad and of suitable length is then placed with its bottom left-hand corner on the centre of the projected image, and so that the left edge lies along the long axis of the scale. On the edge of this strip the position of each winter-band and finally the anterior edge of the scale are marked with pencil. (See the sketch in Fig. 26.)

The exact amount of magnification is of no importance as the measurements obtained are merely relative.

The measurements thus obtained have been used for calculating the size of the fish at the time when the growth of each winter-band was completed. The calculations have been made by taking the measurement from the centre to the anterior edge of the scale as equivalent to the total length of the fish, and from this the value for each winter-band can be arrived at by a proportionate calculation. The calculation is made by means of an apparatus constructed by Mr. Lea and myself, by which the proportionate values of each winter measurement are graphically shown, and by its use we have been able to accomplish the work rapidly and accurately. The apparatus and the method of using it have been fully described by Mr. Lea in the paper mentioned above.

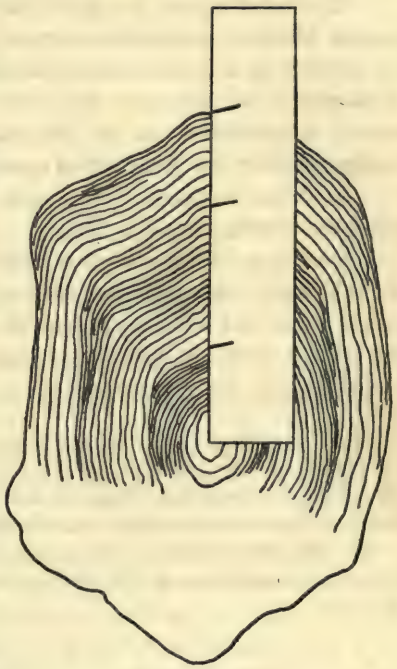


Fig. 26.

In this way I have calculated the lengths of a number of fish on the completion of the first, second, third, &c., winter-bands, and the results thus obtained are shown in the analytical tables of the fish examined by this method.

If one can obtain satisfactory results by the adoption of this method the advantages are obvious. If, for example, I obtain a collection of fifty fish equally divided amongst five different year-classes, it is evident that by ordinary methods I have only ten examples on which to base my calculations for the average length of each class. On the other hand, by adopting this other method I am able to make far more observations. If, therefore, this method is sound a relatively smaller number of examples would be sufficient to enable one to draw up an equally serviceable growth-curve, and we should be able to avoid having to collect such a large number of specimens, and so avoid the enormous amount of time and labour involved in the collection, examination, and analysis of one's material.

I am quite aware that one may adduce reasons for believing that the length of the scale (the anterior or differentiated portion) may not grow in a manner absolutely proportionate to the total length of the fish. Amongst other things, I have found that in the case of trout a slight alteration occurs with age in the relative size of the head and the tail in comparison with

the scale-covered portion of the body. This difference, however, is not large, at any rate in the case of fresh-water trout.*

There is also some uncertainty in connection with the exact demarcation of the winter-band, as this is not an exact line, but consists of a collection of very narrow growth-rings lying close to one another, whose position it is necessary to define.

It is therefore evident that this method may suffer from several small errors, but after some practice and with careful investigation these errors will tend to disappear.

My main object, however, has been to endeavour to prove by practical means whether calculations based on this method of examination will enable us to draw up a growth-curve as reliable as one obtained by ordinary methods of analysis of age and size, and whether we can accordingly arrive at sound conclusions as to the rapidity of growth by the examination of comparatively few individual specimens.

In order to make this point clearer I will give the results of a few analyses which I have made.

Out of a number of examples of salmon from Lister I selected the forty-six fish which had spent one winter in the sea, and measured the length of the scales from the centre of growth to the anterior edge of the same, and also the length from the centre to the boundary of the central portion of the scales formed in the river before migration to the sea. By means of the

* In some fresh-water trout I have measured the total length of the fish, and also the length of the scale-covered portion of the body, reckoning from the angle formed where the gill-cover leaves the cranium. By dividing the total length of the fish by the length of the scale-covered portion I obtain a coefficient denoting the relative dimensions of the two measurements. If no alterations take place in the relative proportions of these two measurements this coefficient would (excluding errors) be constant in fish of all sizes.

Total Length in cm.	Length of Scale-covered Portion in cm.	Coefficient.
3·58	2·32	1·54
3·81	2·51	1·51
3·84	2·52	1·52
3·90	2·60	1·50
9·70	6·60	1·47
12·90	8·70	1·48
15·00	9·70	1·44
15·50	11·40	1·40
21·10	15·60	1·35
21·10	15·00	1·41
21·60	15·50	1·39
22·70	16·00	1·41
25·00	17·50	1·42

values thus obtained I endeavoured to calculate the length of the fish at the time of migration as smolts, and with the following results:—

Smolt Length in cm.	Number of Individuals.
9	2
10	2
11	9
12	8
13	7
14	9
15	5
16	—
17	1
18	1
19	1
20	1
Average length 13 cm.	Total 46

The values thus obtained of the length of these fish when they migrated as smolts are exactly similar to what we know of the general length of smolts when they migrate to the sea. They vary in length, as a rule, between 9 cm. and 15 cm., and may occasionally reach 20 cm. The average length, viz., 13 cm., is a little higher than that which I have found in the Trondhjem district, but later investigations have shown that in the south the average length of the smolt is rather higher than in the north.

In the case of trout, as previously mentioned, I have examined a number of individuals and have classified them, both by analysis of age according to size, and by calculating their size on completion of each winter-band by means of measurements taken from their scales. The results of these comparative investigations have been tabulated by means of growth-curves like the one shown below.

The abscissa axis is divided into winters and months, with a line for every second month. The ordinate axis is divided into centimetres indicating the length of the fish. For the sake of comparison, both here and subsequently in all similar curves and tables, I have assumed that the growth of a trout begins on April 1, as this date may be taken as the average date of hatching throughout the whole country. In the same way January 1 is reckoned as mid-winter.

In the diagram shown below, the dotted line has been drawn through the points indicating the average length ascertained for each year-class by

classification of age according to size.* It thus represents the growth-curve as indicated by one year only, the reliability of which we have already investigated, and which I will call the "empiric curve."

The unbroken line has been drawn through the points indicating the values obtained by calculating the length of all the fish examined at the completion of the first, second, and third, &c., winter-bands and without reference to the year of birth.† This I call the "calculated curve."

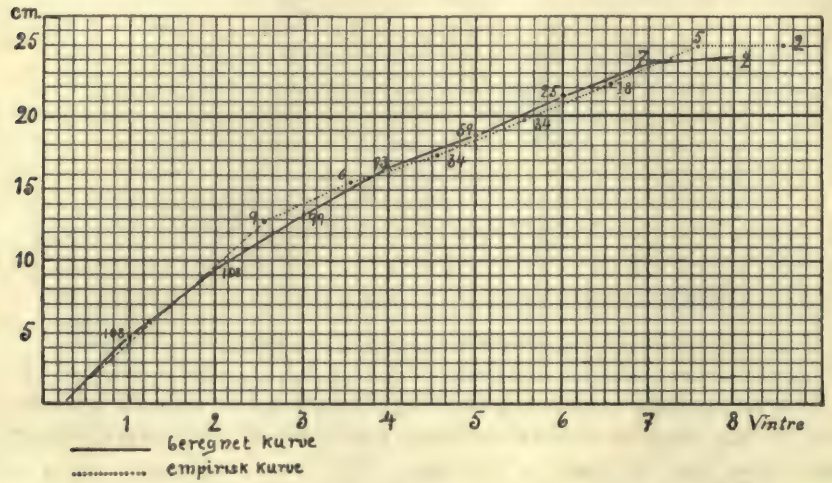


FIG. 27.—Comparison between an "Empiric" and a "Calculated" Curve of the growth of 108 trout caught in the River Chaigijok above Rasti Lombola, Lakselv, Finmarken, July 15 to 20, 1909.

At each observation point on the curve I have put down the number of examples on which the average values are based.

We will now examine a comparison based on the above.

It is easy to see that there is remarkably close agreement between these two curves, so close in fact that it is difficult to imagine any closer coincidence, and especially so when we consider the numerous small mistakes which may occur in connection with the calculations on which these curves are based.

It should also be remembered that neither of these curves should really run in straight lines from the observation points, which in the "empiric curve" are during the summer and in the "calculated curve" in the mid-winter life of the fish. In actuality both these curves should run in waves with their minimum points in winter and the maximum points in summer. This must, of course, follow from the fact that feeding and growth are much

* Cf. Table XXXV. † Cf. Table XXXVc.

less in winter than in summer. For this reason alone it is not to be expected that these curves, which are drawn in straight lines from point to point, would absolutely coincide with one another.

Either curve may therefore be said to give a reliable picture of the rate of growth. It is even probable that the one given by the "calculated curve" is the more reliable, owing to the fact that it is based on a far larger number of observations, and especially in the case of the earlier year-classes, which are the most difficult to obtain in their natural state.

I have drawn up similar comparisons of "empiric" and "calculated" curves for several localities. In each case I have found remarkably close agreement, but I do not consider it necessary to reproduce them here in the form of illustration. Anyone who wishes can easily chart the curves for himself from the average figures which will be found worked out in the various tables, as for instance in Tables XXII., XXIIB., XXIII., XXIIIB., XXXIV. and XXXIVB.

In order to show clearly to what an extent "calculated" growth-curves can be founded on a comparatively small amount of material we will examine more closely the material on which the "calculated" curve for Chaigijok is based. (See Table XXXVB.)

Chaigijok above Rasti Lombola July 15—20, 1909.	Calculated Average Length in cm. on the Completion of each Winter-band.							
	1	2	3	4	5	6	7	8
First 33 fish 10—17 cm.	5 (33)	9·3 (33)	12·3 (24)	14·2 (19)	15·5 (2)	—	—	—
Next 33 ,, 17—20 ,,	4·7 (33)	9·3 (33)	13·2 (33)	16·3 (32)	17·8 (17)	—	—	—
,, 32 ,, 20—23 ,,	4·9 (32)	9·7 (32)	13·8 (32)	17·5 (32)	18·9 (30)	20·9 (15)	—	—
Last 10 ,, 23—26 ,,	4·9 (10)	9·7 (10)	13·8 (10)	15·9 (10)	19·8 (10)	22·2 (10)	23·8 (7)	24·2 (2)
All the 108 ,, 10—26 ,,	4·9 (108)	9·5 (108)	13·2 (99)	16·4 (93)	18·6 (59)	21·4 (25)	23·8 (7)	24·2 (2)
10 ,, measuring 14—25 cm.	5 (10)	9·6 (10)	13·1 (9)	16·1 (8)	19·1 (6)	20·7 (2)	23·2 (1)	24·3 (1)

In the accompanying table I have divided the examples into four groups of various and increasing sizes of fish. For each of these groups the average figures have been calculated of the length of each year-class. In addition I have given the average length for each year-class based on an examination of all the 108 individuals under investigation. Finally, I have selected at random * ten fish out of the whole sample, and the average length figures for these are given separately in the bottom line in the table.

* This selection was made by a lady who had no knowledge of the subject, and who was merely asked to cross out 10 of the total of 108 numbers. The numbers chosen were 11, 19, 31, 37, 50, 61, 70, 84, 92, and 105.

The number of observations on which each average figure is based is given in brackets.

If we compare the average lengths for each of the groups into which our material has been divided with the average lengths based on the whole of the 108 fish, we find the following:—Taking chiefly small fish for our calculations, such as are contained in the first three groups, we find that the average length very closely approximates to that based on the whole of our material, at any rate as far as the younger year-classes are concerned. It is only in the later years, and especially in the last year, that the figures are less reliable. It will further be noted that as we include larger and larger fish in our investigations the more the figures for the later years coincide. If, however, we compare the figures based on the ten largest fish, and also those of the ten selected at random, together with the average of the whole of the 108 fish we find most remarkable agreement. The differences only amount as a rule to a few millimetres, or exceptionally to one centimetre. It is evident, therefore that the errors which might arise from basing one's calculations on only a small amount of material are not likely to exceed 5 or 6 per cent.

It appears, therefore, that one would be justified in basing calculations as to the rate of growth on only a small amount of material, provided, however, that the individuals are fairly distributed amongst the various sizes of fish occurring in a lake, or that they are selected from a few of the largest fish to be found there.

A careful analysis of other similar calculations shows on the whole the same characteristics as the material from Chaigijok, and I give here a similar classification of fish taken from the Sanna Lake, near Harstad.* (See Table XXXIVB.)

Sannavand near Harstad, August 3, 1909.	Calculated average length in cm. on the completion of each winter-band.										
	1	2	3	4	5	6	7	8	9	10	11
First 33 fish 13—24 cm.	5·4 (33)	8·8 (22)	13 (22)	17·6 (14)	20·3 (4)						
Next 33 fish 24—29 cm.	4·3 (33)	8·3 (33)	12·5 (33)	19 (33)	23·6 (20)	25·5 (2)					
Next 33 fish 29—34 cm.	4·8 (33)	9·3 (33)	13·3 (33)	18·1 (33)	25·2 (33)	29·4 (17)	32·5 (2)				
Last 16 fish 34—49 cm.	4·9 (16)	9·1 (16)	13·4 (16)	19 (16)	25·7 (16)	32·4 (15)	37 (10)	41·7 (7)	44·4 (5)	46 (2)	48·2 (1)
All the 115 fish 13—49 cm.	4·9 (115)	8·9 (108)	13 (104)	18·4 (96)	24·6 (73)	30·5 (34)	36·2 (12)	41·7 (7)	44·4 (5)	46 (2)	48·2 (1)
11 fish measuring 16—47 cm.	4·9 (11)	9·7 (10)	14·2 (10)	18 (9)	26 (5)	31·5 (4)	42·2 (1)	43·8 (1)	45·3 (1)	46·4 (1)	

This analysis, in its general features and results, is absolutely similar to what we found in our classification of the fish from Chaigijok. Again

* The fish taken at random were selected in the same way as those from Chaigijok. The numbers were as follows: 9, 22, 30, 38, 50, 62, 69, 81, 90, 102, 113.

we find that the last three groups agree most closely. With one solitary exception the differences are, as a rule, very small, and hardly ever exceed a small percentage of the average length of each year-class. Between the average of the whole of the material examined and the corresponding averages for the eleven fish selected at random, it is only in one instance, viz., the seventh class, that we find a difference of about 16 per cent. This exception may, however, be due to the fact that the figures for the last four winters of the eleven fish group are based on one single individual, and cannot, therefore, be taken as an average representation.

The results obtained from these investigations seem to me to prove sufficiently that we can obtain fairly reliable illustrations of the rate of growth from calculations based on a comparatively small amount of material. It is hardly necessary to add that the specimens should be selected with judgment, and also with some knowledge of local conditions and of the maximum size of fish frequenting the waters under investigation. The results should also not be pressed too far or without allowance for possible sources of error. Still, it is important to know that for all practical purposes it has been found possible to form a fair idea of the rate of growth of fish in any particular locality by merely examining a comparatively small number of individuals.

CHAPTER II.

ON SALMON.

The material on which I have based the statistics of my investigations of the salmon's age and growth is as follows:—

1. Parr and Smolts. (Cf. Table I.).

1908.	Skaugdalselv Rissen	52 fish.
	Orkla	104 „
	Oselv	59 „
1909.	Lakselv, Finmarken	71 „
	Total	286 fish.

2. Salmon and Grilse. (Cf. Tables III.—XIII.).

1908.	Neighbourhood of Christiansand, Season 1908	676 fish.
	Moltuen Icehouse, Imsterfjord, Season 1908	261 „
	Orkla (lower water) Season 1908 . .	244 „
	East Finmarken, July 1908 . . .	89 „
	Total 1908 . . .	1,270 fish.
1909.	Neighbourhood of Christiansand, Season 1909	1,614 fish.
	Moltuen Icehouse, Imsterfjord, Season 1909	184 „
	Bugønes, South Varanger, up to commencement of July, 1909 . . .	285 „
	Total 1909 . . .	2,083 fish.

In addition I have collected a few other examples from various places. All of these have been analysed with reference to the comparative length for age, and also in most cases as regards the weight. The results of this analysis are given in the tables in the Appendix.

(1.) The Age and Characteristics of Parr and Smolts Prior to Migration.

In Table I. I have drawn up the analysis of all the parr and smolts which I have examined. I have investigated as to the size, age, sex, and also as

to how far the sexual organs were developed, *i.e.*, whether the fish would spawn in the following autumn. Disregarding the question of size they are divided in the following table according to their age and the state of the sexual organs.

District.	Number of Fish Examined.	Of these the following had completed																								
		1 Winter.					2 Winters.					3 Winters.					4 Winters.					5 Winters.				
		♂		♀		Total.	♂		♀		Total.	♂		♀		Total.	♂		♀		Total.	♂		♀		Total.
		R.	UR.	R.	UR.		R.	UR.	R.	UR.		R.	UR.	R.	UR.		R.	UR.	R.	UR.		R.	UR.	R.	UR.	
Oselv .	59	1	8	—	17	26	9	8	—	14	31	2	—	—	—	2	—	—	—	—	—	—	—	—	—	—
Orkla .	104	—	2	—	3	5	4	34	—	44	82	5	5	—	7	17	—	—	—	—	—	—	—	—	—	—
Lakselv .	71	—	—	—	—	—	—	2	—	1	3	2	1	—	1	4	32	2	—	29	63	1	—	—	—	1

UR. Unripe, *i.e.*, sexual organs not matured.
R. Ripe or ready to spawn in autumn.

As the above fish were caught between July and September, it is evident that the age when migration would take place would have to be increased by another winter, as they must spend another winter in the river before they could migrate as smolts in the following May or June.

As regards the relative proportion of fish of different ages the table cannot give any conclusive evidence, since all the fish were caught either with fly or hook. For that reason the smallest class of fish would not be so fairly represented as the older and larger fish. In most places it is impossible to catch the fish in any other way. The same objection applies also to drawing any conclusions as to the relative size of the various ages, which one can, however, study with the help of the tables in the appendix.

Our table shows us two things clearly.

First, we must note a very distinct tendency for the fish to remain longer in the river in the northern regions than further south. We have further confirmation of this, as will be seen later from the other tables.

Secondly, on investigating the sexual organs we find a remarkable circumstance. The female fish were all without ova, but of the males a not inconsiderable number were ripe. From the swollen milt it was evident that many of these would spawn in the ensuing autumn.

That these small male fish were really ripe was confirmed by examining similar male fish in the late autumn. They then had free running milt, which on microscopic examination was found to contain living spermatozoa.

The table also shows clearly in what proportion the sexually developed male fish are distributed among the various year-classes.

We see that in the Oselv there was only one ripe male among the fish which had completed their first winter, whereas among the two-winters fish

there are about as many ripe as unripe. Among the three-winters fish all the males are ripe.

In the Orkla some of the two-winters fish are ripe, and among the three-winters fish there are as many unripe as ripe.

In Finmarken these conditions are postponed until a year later. With reference to the age at migration, the only conclusion we can draw from the table are as to the maximum age up to which the parr remain in the river. In order to find out the age of migration it would be necessary to catch the smolts when migrating, and to study their age. Here one immediately meets the difficulty, that in certain cases it is a question whether the fish has or has not the migratory colouring. In my opinion it is therefore a safer method to obtain one's information by examining the central portion of the scales of larger fish, and this is the method I have adopted.

With reference to the time of the year when migration takes place, my previous investigations, both with salmon and sea trout, pointed to the fact that the main period of migration is during the spring, when the rivers are flooded with melting snow. At the same time during the summer one could find fish with the migratory dress (*i.e.*, with more or less silvery coating), especially in the lower reaches of the river. I concluded, therefore, that migration also took place during the course of the summer.

Further investigations showed that "silveriness" is not an absolute proof that migration will immediately take place, for I have found amongst other things that male fish with well developed milt, caught during the summer, can be fairly silvery in colour. The assumption of the silvery coating can thus apparently begin a long time before migration.

In the Trondhjem district the largest migration took place in June. Further south May seems to be the most important month.

In the Oselv in 1909 I fished with a net to catch smolts for marking. For this purpose I chose a suitable place in the river about 100 metres long. The net was sufficiently long to sweep the whole breadth of the small river, and this place was fished for a considerable time almost every day. The smolts were migrating continuously, and at the height of the run no falling off was noticed in their numbers, even though we made cast after cast in the same water, and school after school came down through the same reach. The netting began on May 10, when it was noticed that there was a considerable number of bright and large fish migrating, but towards the end of the month the catch fell to a minimum in spite of all attempts that were made. The numbers caught were as follows:—

May	10 and 11	. . .	613 fish.
	13 „ 15	. . .	327 „
	18 „ 19	. . .	211 „
	21 „ 26	. . .	64 „

The few which were forthcoming at the end were nearly all quite small, and of the typical bluish brown and copper coloured shades, which characterise the growing parr. The migration of the class of fish caught in the earlier part of the month was apparently over. We tried in other places but we did not find it worth while continuing.

It is therefore not probable that there is any large migration during the summer, though odd fish may occur. Examination of the central portion of the scales of larger fish also shows that only a few have any signs of summer growth in the river after the last winter prior to migration.

2. Salmon after Migration.

As I mentioned before, in dealing with the methods of investigation which I have adopted, with the help of a microscope the scales reveal the following facts.

We can easily distinguish the boundary line which marks the entrance into salt water. If we study the central portion of the scale (the river life) with higher magnification we can count the number of winters the fish has spent in the river. For example, compare Figs. 9b, Plate II., 10b, Plate III., 11b, Plate IV., which represent enlargements of the central portion of the scales.

Further, it can be seen how many winters the fish has completed in the sea after migration, and also whether the fish has a spawning mark or not.

As an example of the methods I have adopted let us examine Table VIII., which contains the analysis of 1612 salmon from Christiansand in the season of 1909. As will be seen from the table, I have arranged the fish according to their length in centimetres, and in a separate column I have noted how many fish belong to each class.

I have examined the scales of each class microscopically, and have determined how long each fish has lived in the river prior to migration, and how long it has lived after migration, and also whether it has previously spawned (*i.e.*, whether it has a spawning mark). According to the results of this examination the fish have been classified under the various headings. Fish which are returning to spawn for the first time are denoted in ordinary figures, but those which show a spawning mark, and which have consequently spawned on a previous occasion, are denoted in brackets. In the same way each centimetre or length-class is dealt with in turn until the whole are completed.

The headings of the table are arranged so as to make it clear whether the fish have completed one, two, three, four, five, or six winters subsequent to migration. Under each of these main headings the fish are again divided

by sub-headings, showing whether they migrated when two, three, four, or five winters old, and how large they were on the date of capture. In the final column is given the size and the total number of fish caught of each year-class divided according to the number of winters completed subsequent to migration.

At the foot of the table we have the total of the various sub-divisions, together with their average length.

From this table we can read the following:—

The number of years of river life before migration.

The years of sea life before spawning.

The relative occurrence of previous spawners.

The average length in centimetres of the various age-classes.

From the arrangement of the dating at the head of the column we can also readily tell the year when the fish were hatched.

In a similar manner the same material has been divided and arranged according to the fish's weight (see Table XI.).

All averages are reckoned from the original tables, which were afterwards arranged for printing purposes, so that the length classes were in divisions of 3 centimetres, and the weight classes of 7 hectograms.

In the same way the whole of the material has been arranged in separate tables for each locality.

From these tables we can obtain information on the two following points in the life history of the fish which I now propose to discuss separately, and which I shall endeavour to further elucidate with the help of other material in my possession.

(a.) *The Age of the Smolt at Migration.*

In the table below I give the total number of fish from each of the various districts, examined in 1908 and 1909, and in the separate columns is shown how many of these migrated after an age of two, three, four, or five winters.

1908.

District.	Number Examined.	Of which on Migration the following Number and Percentage had Completed			
		2 winters.	3 winters.	4 winters.	5 winters.
Christiansand .	667	223 (33·5 %)	408 (61 %)	34 (5 %)	2 (½ %)
Trøndelagen . .	498	66 (13 %)	359 (72 %)	68 (14 %)	5 (1 %)
Øst-Finmarken .	87	7 (8 %)	52 (60 %)	24 (27 %)	4 (5 %)

1909.

District.	Number Examined.	Of which on Migration the following Number and Percentage had Completed			
		2 winters.	3 winters.	4 winters.	5 winters.
Christiansand .	1612	296 (18 %)	1097 (68 %)	207 (13 %)	12 (1 %)
Trøndelagen . .	184	11 (6·5 %)	124 (67 %)	48 (26 %)	1 (½ %)
Øst-Finmarken .	284	7 (2·5 %)	133 (47 %)	124 (43·5 %)	20 (7 %)

A close examination of these tables shows that the age of the smolts at migration varies between two and five winters. In the south the smolts are generally young, but the farther north we go the more pronounced is the tendency for the fish to remain longer in the river before migration. This is clearly seen from a comparison of the percentage of the different year-classes, and we also find that in both tables the main features are identical.

It will be remembered that it was previously pointed out that a direct examination of fish caught in the rivers in the same districts (see p. 31) showed that the river life tended to lengthen as we proceeded northwards, and we have now been able to confirm and strengthen this theory by other methods of investigation.

(b.) *The Length of the Salmon's Life after Migration.*

The two following tables show in condensed form the results of my analysis of the salmon and grilse caught in 1908 and 1909 :—

1908.

District.	Number of fish Examined.	Of which the following number had completed after migration					
		1 winter.	2 winters.	3 winters.	4 winters.	5 winters.	6 winters.
Christiansand .	676	239	366 (17)	26 (25)	(3)	—	—
Trøndelagen . .	505	47	318 (2)	127 (9)	1 (1)	—	—
Øst-Finmarken .	89	16	21	48 (1)	2 (1)	—	—

1909.

District.	Number of fish Examined.	Of which the following number had completed after migration					
		1 winter.	2 winters.	3 winters.	4 winters.	5 winters.	6 winters.
Christiansand .	1612	618	855 (34)	51 (49)	(4)	—	(1)
Trøndelagen . .	184	44	75	54 (4)	(5)	(2)	—
Øst-Finmarken .	284	—	24	227 (7)	3 (18)	(5)	—

Maiden fish which have not spawned are shown in ordinary figures; those with a spawning mark are placed in brackets.

These tables tell us several things of great importance.

Firstly we notice that the salmon does not live many years after migration. Most of the fish have spent from one to three winters in the sea. A salmon, whose scales show more than four winters after migration, is an extraordinary exception.

In the same way the tables show us that the large majority of the fish, on which our fisheries depend, consists of fish which have not spawned before and which are entering the river for the first time to spawn. It will also be noticed that these maiden fish are not all of one age, but may have spent from one to four winters in the sea before they attained sexual maturity.

This clearly shows that the salmon, which in each year are the material for our fisheries, and which are making their way up to the rivers, are not the whole of the fish in existence. They form only a portion of the various year-classes to which they belong, a portion which is on the point of becoming sexually mature, and which, as it were, has broken away from the rest for the purpose of spawning. This is made even clearer by an investigation of the sex of the fish. It was impossible for me to include such investigations with my analysis of age on a large scale, for it would have necessitated cutting each fish open, the expense of which would have been prohibitive. I have, therefore, been compelled to restrict myself as far as this point is concerned to investigations on a small scale.

In Table XIV., I have given the results of such investigations. I cut open and examined the sexual organs of forty-eight small salmon caught in the district between Trondhjem and Finmarken in the beginning of July. All the fish which had completed only one winter in the sea, as will be seen from the table, were males. The hen fish were only to be found when I came to examine fish which had spent two winters in the sea.

As will be seen from all the tables the fish which have spent one winter in the sea vary in length between something over 40 centimetres and about 67 centimetres, and by measurement alone we were therefore able to distinguish a good many of the one winter old fish (see for example Table VIII.).

Now we have a number of measurements taken from a good many rivers of the size of parent fish, which had been obtained for hatching purposes, and which after spawning had been used for marking experiments. In these measurements the sexes have been carefully distinguished. Herr Landmark, the Government Fishery Inspector, has kindly lent me his list of these measurements.

With the help of these I have compiled all the available measurements relating to the size of each sex from the Aaensire, Laerdal and Drammen

rivers (see Tables XV. and XVI.). These tables show clearly that an overwhelming majority of the fish under 58 centimetres length are males. In some years there can be more females of this size, but over a period of years far and away the larger number are males. As will be seen, fish of this size consist almost entirely of those which have spent only one winter in the sea, although there may be some fish of two winters age among them. It is quite possible that it is just these latter fish which are females.

We can therefore safely conclude from these tables that the salmon which we catch and which have only spent one winter in the sea are almost entirely males.

And, when this is compared with what has previously been set forth, it provides us with a striking proof that the salmon which, after one, two, or three winters in the sea, approach the coast, and which form the material for the fisheries in our waters, form only a portion of the year-classes to which they belong. They consist of that portion torn away from the others by force of the spawning instinct.

Let us now again examine the tables on p. 35. If we compare the proportion of maiden fish to those which, as seen from the spawning mark, have previously spawned, we find that the number of the former is far and away the larger. If we arrange the latter in the form of percentages for the various districts in the two years under examination we obtain the following tables :—

	Percentage of Fish with "Spawning Mark."	
	1908.	1909.
Christiansand . .	8 %	6 %
Trondhjem . . .	2 %	6 %
East Finmark . .	2 %	10 %

As is clearly shown, only a very small portion of the whole have spawned before and are returning to spawn for a second time.

It would appear, therefore, that the operation of spawning is a factor which has serious effect in shortening the fish's life, or, indeed, in abruptly ending it, and this is easily understood when one thinks of all the dangers the fish has to pass through during its spawning journey, and among which by no means the least are the snares and traps of mankind. The violent changes of conditions to which it is subjected during its long journey, during the long fast in fresh water, and during the labours in the actual act of spawning, are bound to be fatal in their effects. Many die, many are like living corpses when they again make back to the sea, and they must

undoubtedly remain for a long time in an emaciated and weak condition before they reach the surroundings which can provide them with the powerful nourishment which they require.*

The importance of the spawning journey as a factor of destruction in the life of the salmon is shown more clearly when one takes into consideration the number of fish whose scales show two "spawning marks." In the whole of my material, which consist of 3,350 individuals, I have found only three specimens whose scales showed two spawning marks, that is to say, only three individual fish which had survived the second spawning.

In order to throw further light on this question I have examined my material with a view to discovering the period when the spawning mark is formed.

Those salmon which in the summer approach our fjords and rivers, and whose scales show one, two, three, or more winter-bands after migration, spawn in the autumn or winter, and consequently are in the second, third, or fourth or corresponding winter after migration. The winter in which spawning occurs can, as has been previously shown, be determined by examination of the scales, with possibly a few exceptions. After a series of investigations I have drawn up the following tables :—

1908—1909.

District.	Number of Fish with Spawning Mark.	Number and Percentage of Fish whose Scales showed a Spawning Mark in Winter after Migration.		
		2nd.	3rd.	4th.
Christiansand . . .	133	124 (93)	9 (7)	
Trøndelagen . . .	25	14 (56)	9 (36)	2 (8)
Øst-Finmarken . . .	31	8 (26)	20 (65)	3 (9)

This table shows us first that the salmon's age on the first spawning is generally greater in our examples from northern than from southern districts. Secondly it makes it clear that it is chiefly the fish which have spawned at an early age that return to spawn for a second time. The great majority of the fish which in the summer are two and three winters old

* The following note is given as an illustration of the food taken by salmon. In the year 1909, between June 30 and July 2, I opened and examined the stomachs of 49 grilse caught between Trondhjem and Finmarken. In 26 cases the stomachs were empty or contained only an indefinable pulp. In 17 fish I found herrings up to 20 cm. in length, and in some cases the stomachs were absolutely crammed with these fish. In three cases the contents consisted of capelan (*Mallotus villosus*). In two cases I found the stomachs were full of Euphausidæ, partly mixed with pelagic amphipods. In one case the stomach was crammed with the pelagic amphipod (*Parathemisto oblivia*).

and which spawn for the first time in their third and fourth winter, very seldom reappear in the form of fish with a spawning mark.

This evidently points to the fact that few of the older fish survive more than one spawning.

With reference to the duration of time which elapses before a fish which has once spawned again returns to spawn, the study of the scales with spawning marks affords useful information. With certain reservations one can read from the scales how many summers and winters have elapsed since spawning occurred. To illustrate this I have drawn up the following table, which shows the length of absence after the first spawning. These figures must not be regarded as absolutely correct, but they are sufficiently so for comparative purposes :—

1908—1909.

District.	Number of Fish with Spawning Mark.	Number and Percentage of Fish, whose Absence after the First Spawning was		
		1 summer.	2 summers.	3 summers.
Christiansand . . .	133	52 (38)	79 (60)	2 (2)
Trøndelagen . . .	25	6 (24)	19 (76)	
Øst-Finmarken . . .	31	1 (3)	28 (90)	2 (7)

Here, too, we seem to be able to trace a difference between the northern and southern districts as regards the variation in the fish's absence after the first spawning.

Let us now sum up briefly what we have learnt from our investigations as to the age of the salmon after migration.

Everywhere throughout the country where our investigations have been conducted we find that our material is composed as follows :—

By far the largest majority consists of fish which have never spawned and which have remained in the sea from one to three and exceptionally four winters, and which are therefore in their second to their fifth summer after migration.

These fish spawn in the second to the fifth winter after migration, and apparently only a portion of them—chiefly composed of the younger fish—survive the spawning journey and the actual spawning. This little band of survivors returns again to the sea, and some of them after the lapse of one year, others after two years, and very few after three years interval, return to spawn for the second time. Only an infinitesimal portion of these, about one in a 1,000, have shown that they have returned to spawn for the third time.

Let us now consider:—

(c.) *The Salmon's Growth after Migration.*

Tables III. to XIII. contain all the information which our investigations are able to give concerning this question. If we examine the different tables we find that the individual fish which belong to each year's class vary very much in size within certain limits. At the same time these variations arrange themselves in more or less regular Galton curves.

In order to obtain a useful illustration of the growth which each single age-class has made, we must turn our attention to the average sizes, which have been calculated for each age-group, both as regards length and weight.

By means of these averages I have compiled the following tables of the results of my analysis for the years 1908 and 1909.

The tables contain the average length and weight which I have found in my analysis of salmon which had lived one, two, or three winters subsequent to migration. Maiden fish and those with spawning marks are treated separately. In a separate column for each year's class I give the number of fish on which the averages are based. Everyone can therefore judge for himself how much reliance should be placed on them.

I have omitted from the tables fish of more than three winters after migration, as their number is so small that an average based on so small an amount of material would have but little value.

Locality.	Year.	Number and Average Length and Weight of Fish which after Migration have Lived								
		1 winter.			2 winters.			3 winters.		
		No.	Length in cm.	Weight in hecto.	No.	Length in cm.	Weight in hecto.	No.	Length in cm.	Weight in hecto.
Maiden Fish.										
Christiansand	1908	239	56·2	16·8	366	73·2	39·7	26	98·7	111·6
	1909	618	54·9	17·1	855	73	41	51	91·3	88·4
Moltuen	1908	28	54·9	17·9	166	76·2	50·9	56	95·6	105·9
	1909	44	56·1	19·5	75	75·4	49·1	54	94·9	100·8
Orkla.	1908	19	56	18·2	151	81	59	71	96·9	105
East Finmark	1908	16	58·3	20·5	21	76·8	49·1	48	93·3	96·3
	1909	—	—	—	24	73·9	44·2	227	89·1	79·9
With Spawning Marks.										
Christiansand	1908	—	—	—	17	65·5	27·4	25	74	41·1
	1909	—	—	—	34	61·2	22·9	49	75·1	42·7
Moltuen	1908	—	—	—	3	60·5	25·5	7	82	67·5
	1909	—	—	—	—	—	—	4	88·8	78·5
Orkla.	1908	—	—	—	—	—	—	2	88	83·5
East Finmark	1908	—	—	—	—	—	—	1	79	53
	1909	—	—	—	—	—	—	7	76	46·7

If we examine this table we find that the average weight we have found for the various age classes is different in the different localities. If we disregard the question of the correctness of these average figures, and also the fact that the fish in the corresponding age-class may not all have been caught in exactly the same period (perhaps also may not have been hatched or may not have migrated at exactly the same period of the year),* we still find that salmon of corresponding age-classes are not of the same size throughout the whole country. Nor are they of the same size in different years.

If we put this in tabulated form it becomes clearer.

FISH WITHOUT SPAWNING MARK.

		Variation in the Average Weight and Length of Fish which after Migration had Lived		
		1 Winter.	2 Winters.	3 Winters.
Length in cm.	1908	54·9—58·3	73·2—81	93·3—98·7
	1909	54·9—56	73 —75·4	89·1—94·9
Weight in hectogr.	1908	16·8—20·5	39·7—59	96·3—111·6
	1909	17·1—19·5	41 —49·1	79·9—100·8

An exact determination of the growth of salmon for the whole country can therefore not be obtained on the basis of this material. We cannot do more than say that the growth appears to vary within the limits mentioned above and shown in this table.

If we examine the table on page 40 we find also that the relation between length and weight is different in different localities. Herr Landmark has previously endeavoured to demonstrate this fact by weighing and measuring salmon whose age was unknown. Now that we can separate the fish into groups according to their age this difference is confirmed, but it is not a difference of great magnitude.

It was hoped that one could establish the fact of race characteristics with the aid of the variations which a comparison of weight and length showed to exist in various localities. If we examine the table carefully it appears that there is not much probability of this.

If we examine the one winter old fish from Christiansand, where the material was largest and the most reliable, we find that in 1908 they were 56·2 cm. in length and weighed 16·8 hectos, whereas in 1909 they were

* With a fish which grows so rapidly as the salmon considerations of this sort are bound to affect the average.

much shorter and nevertheless were heavier. This is also the case if we examine the two winters old fish from the same locality. The yearly variation in the proportion of weight to length in the same district can therefore be so large that one year may show just the contrary to another year. It would therefore involve us in many difficulties if we attempted to establish this proportion as a means of studying the question of race.

There is yet another point, on which the average figures which we have collected in our table on page 40 give us clear elucidation. That is the proportion between the growth of maiden fish and that of fish whose scales have spawning marks, and which, therefore, have returned to fresh water on a previous occasion to spawn.

As an example let us take the figures shown in the table for Christiansand in 1909.

	Average Length and Weight of Salmon which after Migration had Completed			
	2 Winters.		3 Winters.	
	Length in cm.	Weight in hectogr.	Length in cm.	Weight in hectogr.
Fish without spawning mark	73	41	91·3	88·4
Fish with spawning mark .	61·2	22·9	75·1	42·7

This table shows us quite clearly what a serious check the spawning journey and the actual spawning itself put on the growth and the weight of the fish. Whereas two winters old fish which have never spawned are 73 cm. long and weigh 41 hectos, fish of a corresponding age, but which have spawned in the previous winter, are not more than 61·2 cm. long and weigh only 22·9 hectos; and whereas a three winters old maiden fish is 91·3 cm. in length and weighs 88·4 hectos, a salmon of the same age, but which has previously spawned, whether in its second or third winter, is only 75·1 cm. in length and weighs on the average not more than 42·7 hectos; that is to say, little more than a maiden fish which has been a year less in the sea subsequent to migration.

This clearly shows how great is the retrograde influence on the growth of the salmon of the act of spawning and of the difficulties and privations connected therewith.

It is easy to see that this must be the case, for while one salmon remains in the river for many months, fasting and becoming emaciated, on the other hand the unripe fish of corresponding age remains in the sea,

feeding and growing, and until it greatly surpasses in weight its contemporary in the river.

And if such a fish spawns and survives to regain salt water, a long time must elapse before it can recover merely the weight it has lost in the river and until it can begin to increase in size over its original weight, when it first left the sea for the act of spawning. Consequently it can never reach the normal weight for maiden fish of corresponding age.

The whole of the material in my tables shows the same conditions, and I have merely selected the above as a characteristic example.

(d.) *The Relative Occurrence of the Different Age-Classes in Different Localities.*

It has long been known that the salmon of the north and those of the south—for example, from the neighbourhood of Trondhjem or of Christiansand—are different in size. In the north they are considerably larger than in the south.

Herr Landmark has proved this by a large number of measurements, and in my investigations, with the help of several firms, I have collected a quantity of material which clearly proves the correctness of this theory.

In a number of the icehouses where fish are bought there exist statistics spread over many years giving the total catch and weight of grilse (fish under 3 kilos) and of salmon (fish of 3 kilos and over) which have passed through each fish-house.

I have collected the statistics which I have obtained from the Christiansand and Trondhjem districts, together with those of the fish caught with rod in the State-owned rivers in Finmarken. (See table below.)

The table shows us two facts. In the first place the quantity of grilse in proportion to salmon decreases as we proceed northwards. Secondly, the average size of both grilse and salmon increases the farther north we go. This is especially the case with salmon.

District.	Years.	Grilse.		Salmon.	
		Number of fish Weighed.	Average Weight in kilo.	Number of fish weighed.	Average Weight in kilo.
Randøsund and Flekkerø Export Association, Christiansand . .	1895—1909	38,012	1·9	38,006	4·9
Moltuen Icehouse, near Trondhjem .	1898—1908	3,387	2·1	6,173	6·9
Utvorden Icehouse, Namsenfjord .	1898—1908	5,010	2·3	13,027	6·8
Rod fishing on salmon rivers, Finmarken	1898—1909	152	—	495	9·2

The number of years and the quantity of fish which are included in these statistics are so large, both for the Christiansand and for the Trondhjem districts, that there is no room left for doubt that the difference which we

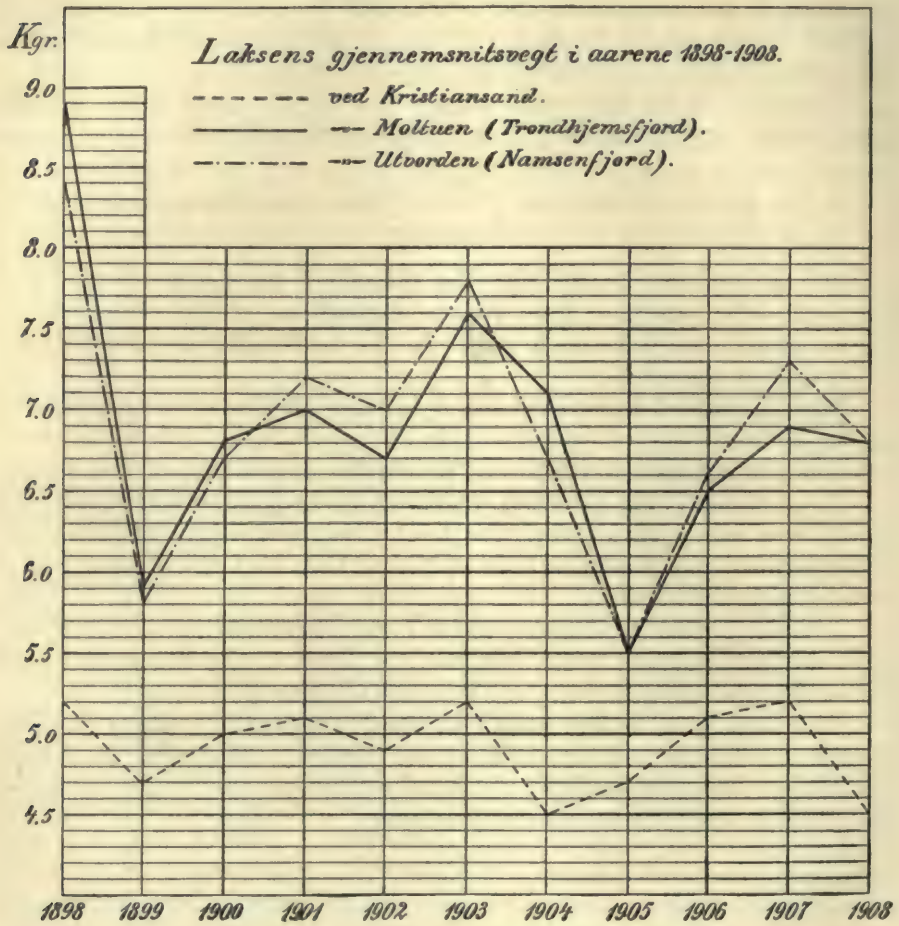


FIG. 28.—Annual Average Weights of Salmon (fish of three kilos and upwards) at Christiansand, Moltuen (Trondhjems fjord), and Utvorden (Namsen) during the years 1898 to 1908.

find between these two districts must be regarded as a permanent characteristic of the difference which is generally found between the catches in these different localities.

A yearly variation is noticeable both in the proportion of salmon to grilse as well as in the average weight.

As regards the annual fluctuations in the average weight we find most remarkable coincidences between the various districts, as will be seen from the curves in the accompanying chart. (See Fig. 28.)

In the first place we notice that the yearly variations in the average weight of the fish are so considerable that they must be an important factor in the annual yield of the fisheries. Secondly, we must note that these variations follow one another with considerable regularity. It is obvious that there must be some common cause responsible for the regularity with which in the various years the average weight rises or falls simultaneously in districts which are so remote from one another,

In Finmarken the statistics are less convincing. It has been difficult for me to obtain even this small amount of material from the Lakselv, consisting of the fish which the lessee had caught in the State waters in the years 1898 to 1909.

We have statements also from a number of icehouses, both in Nordland and Finmarken, but unfortunately they are of no use for a direct comparison, as the division between grilse and salmon in this district is arranged on a different system from that prevailing in other parts of Norway. As mentioned before, throughout the rest of the country the division between grilse and salmon is reckoned as 3 kilos, whereas in the northern districts it varies from 3·5 and 4 kilos in Nordland and Tromsø up to 6 kilos in Finmarken. This renders a direct comparison impossible, and one can only form approximate estimates.

Nevertheless, the following statistics obtained from the ice-houses in Norskholmen, Tana, and Bugønes, in Sydvaranger, for the years 1903 to 1908 are characteristic of East Finmarken.

Locality.	Number of Grilse under 6 kilos.	Number of Salmon of and over 6 kilos.
Norskholmen Tana .	1633	1670
Bugønes-Sydvaranger	3063	3023

As will be seen, these figures leave one in no doubt that actual grilse (*i.e.*, fish under 3 kilos) are far less numerous than salmon.

In the districts between Trondhjem and West Finmarken the proportion varies considerably in different localities, and there are places where we find that fish under 3 kilos are the most numerous, as, for instance, in the small fjords around the Vestfjord, and possibly also on the outer side of Sørø.

So far as the southern coast is concerned, I should not like the

statistics previously given to be taken as representing anything more than the localities to which they refer. It is well known that the catches in certain places—for example, in Jaederen—sometimes consist almost entirely of grilse.

The tables given above must therefore only be regarded as typical examples of the fact, which long experience has shown to be correct, that salmon in the north are larger than those in the south,

What, therefore, is the reason of this difference?

If one fish is larger than another we are naturally inclined to think that it is because it is older.

Let us therefore again examine the statistics which have been compiled from the material which we have examined from Christiansand, Trondhjem, and East Finmarken.

For the purpose of comparison let us arrange the various age-groups according to their percentage. (See the accompanying table.)

Year.	District.	Percentage of Fish which after Migration had Lived					
		1 winter.	2 winters.	3 winters.	4 winters.	5 winters.	6 winters.
1908	Christiansand	36·8 %	56·7 %	7·5 %	0·4 %	—	—
—	Trøndelagen	9·3 %	63·4 %	26·9 %	0·4 %	—	—
—	Øst-Finmarken	17·9 %	23·7 %	55·1 %	3·4 %	—	—
1909	Christiansand	38·2 %	55·2 %	6·2 %	0·3 %	—	0·1 %
—	Trøndelagen	24 %	40·7 %	31·5 %	2·7 %	1·1 %	—
—	Øst-Finmarken	—	9·2 %	82·4 %	7·4 %	1·8 %	—

An inspection of these tables clearly shows that the salmon in the Trondhjem district are distinctly older than in Christiansand, and that a similar difference is noticeable between Trondhjem and East Finmarken.

It must, however, be noted that the material from East Finmarken is, unfortunately, not large, and there is also the disadvantage that it does not represent the whole season. The examples of 1908 were caught in the middle of July, and therefore at a time when the actual season for large salmon is over, and which is generally characterised by the predominance of small salmon and grilse. This table, therefore, probably gives too high a relative value to the younger fish. In 1909 the buying of fish at the Bugønes Ice-house in Sydvaranger was discontinued at the beginning of July, and consequently put an end to my collection. For the same reason as before, the material collected in this season overrates to some extent the larger and older fish.

Neither of these two examples above can therefore be regarded as

absolutely representative of the general stock of fish in each year, but taken together they leave no doubt that the salmon in East Finmarken are distinctly older than those in the neighbourhood of Trondhjem.

Our investigations therefore seem to indicate clearly that the salmon caught in the north are, on the average, considerably older than those caught farther south, and that this is one of the chief reasons of the difference in size which has so long been recognised.

Let us now inquire whether the average weight of the various year classes can also be regarded as a contributing factor to the difference in the size of the fish in the various districts. For this purpose we may compare the average weights previously given in the table on page 40.

Locality.	Average Weight in hectogrammes of Maiden Salmon which after Migration had lived					
	1 winter.		2 winters.		3 winters.	
	1908.	1909.	1908.	1909.	1908.	1909.
Christiansand . . .	16·8	17·1	39·7	41	111·6	88·4
Moltuen	17·9	19·5	50·9	49·1	105·9	100·8
Orkla	18·1	—	59	—	105	—
Øst-Finmarken . .	20·5	—	49·1	44·2	96·2	79·9

As we see from this table, there is some difference in the average weight of salmon of the corresponding year-classes in the different localities. Possibly this is due to an actual difference in conditions, or it may be that it is merely the result of chance. With so rapidly a growing fish as the salmon, the date of capture must have an important influence on the average weight; and for this reason, when instituting a comparison between the different localities, we must not place implicit confidence in the results obtained.

As we see, the difference is not so great, nor is it sufficiently regular to explain fully this variation which we have previously shown to exist in the various districts (*cf.* page 43) even though it may possibly be a contributing cause.

In the same way we notice in the tables an annual variation in the average of salmon belonging to the same year-classes. This is, however, not important enough to explain the large annual variations which we found in the average weights of fish over 3 kilos. (See page 44.)

It is most probable that annual variations in age-composition in this respect play a very important *rôle*. That such variations do exist is apparent if we examine the tables in which the age groups are arranged according

to the percentage (see page 46). Here we see that the percentages of the different age-classes vary from year to year, but we can only arrive at a sound conclusion as to the extent of this variation by continuous investigations spread over several years.

What is the meaning of the greater age which we find in comparing our examples from the north with the south? Does it indicate that salmon have a tendency to migrate northwards as they get older, or does it indicate that northern salmon take longer to become mature, and that it is only when they are older that they approach the coast and proceed up the rivers?

It is impossible to reply with any degree of certainty, but the circumstances are exceedingly striking and deserve further study.

I will only merely mention the fact that the materials I have collected seem to indicate that both the above-mentioned factors may contribute their share.

As will be remembered in our discussions on the age of the smolts before migration, and as to the occurrence of the spawning mark in reference to age, we found the following facts. The smolts remain longer in the rivers in the north than in the south, and if we investigate the age of fish, when the spawning mark was first formed upon their scales, we find that they must on the whole have been older, which moreover directly follows from the fact that the stock of fish generally is older. After spawning, the salmon, as far as we can discover (see page 39), also remains longer in the sea in the north than in the south, before it returns to spawn for the second time. It would seem as if all the functions of the fish are more retarded the further northwards we go. Ordinary physiological considerations would lead one also to expect this, and there can be little doubt that this condition must to some extent make itself felt.

In order to elucidate the question of the wanderings of the salmon I have endeavoured to ascertain whether the markings carried out by Herr Landmark afford any indications. These markings were almost all made on spawning salmon, that is to say, fish whose chances of survival, in the light of what we have discovered, could only be regarded as small. That is presumably the reason why of the many thousands of salmon which were marked so few fish have been subsequently recaptured.*

* During the years 1893 to 1895, 6708 fish were marked in the rivers, principally spent fish and kelts, and only 221 fish in all have been recaptured. Of these 221 salmon, 43 were caught again before they had migrated to the sea, 54 were recaptured in the sea, and 112 on their return to fresh water, and in the majority of cases in the same rivers where they were originally marked. During the same period 140 clean fish were marked which were caught among the islands along the coast. Of these 23 were recaptured, and in all cases in the same season in which the marking took place. (Landmark, "Merkning af Laks," Norsk Fiskeritidende, 1905, p. 487.)

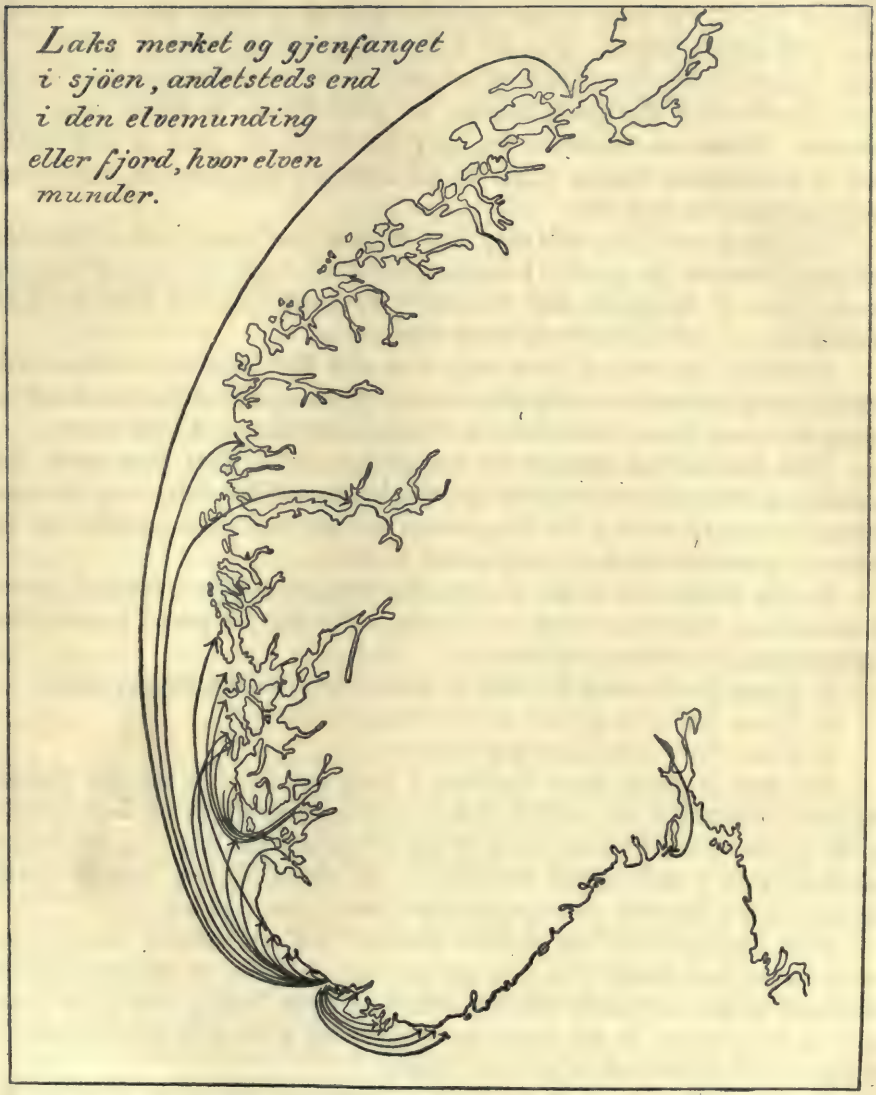


FIG. 29.—Map of Southern Norway, showing the Migrations of Salmon which were marked as Kelts in various rivers (Drammen, Sire-Aa, Figgen and Sand), and which were recaptured in the sea elsewhere than in the mouth or fjord leading to the river where the fish were originally marked.

As is well known, Herr Landmark's marking experiments indicated that many fish have a great tendency to return to the river where they were marked, but all the same a fair number may go to other places. On the map of Southern Norway (Fig. 29) I have indicated the tracks followed by those salmon which have been recaptured in the sea elsewhere than in the river mouths or in the fjords leading to those rivers in which they were marked. These are, therefore, the only fish which can give us any indication of where those fish go which do not return to the river in which they were marked (see Fig. 29).

We see at once from this map that most of the tracks have a noticeable tendency towards the north. I have drawn a line from the place of marking to the place of recapture, and naturally we know nothing further of the wanderings of the fish between these two places.

Naturally, we cannot draw any sure and final conclusions from this, but taken in connection with what we saw of the age distribution of salmon along the coast, these wanderings are both interesting and instructive.

That they do take place is an established fact. That they must play a certain part in the remarkable age distribution of the fish along the coast cannot be denied, even if for the present we are not in a position to say precisely what weight we should attach to them.

In this connection it will also be interesting to compare the distribution of the salmon fisheries along our coasts. For this purpose I have divided up the coast into three divisions:—

1. From the Swedish frontier to Jaederen (to the Stavanger Amt).
2. From Jaederen to Stat (to the Romsdal Amt).
3. From Stat to the Russian frontier.

For each of these three districts I have put down from the Fishery Inspector's statistics the weight of salmon caught in the years 1880 to 1906 in the whole of the fisheries both in the rivers and the sea. In the accompanying table I have given the results in round figures, together with the proportion between the separate yield from river and sea.

It is possible that the figures obtained are not strictly comparable, owing to the fact that it is only in recent years that the sea fishing has been developed in the northern districts, whereas river fishing has been going on for a long time. In the same way difficulties arise as to the comparison of the statistics from other parts of Norway.*

However, if we take the figures as they are our table gives us the following.

We see that in the south the river fisheries are of much greater

* For example, we have disregarded the fact that the leasing of rivers for sport fishing, *i.e.*, as opposed to netting or trapping, is much more extensive in the north and west than in the south.

importance compared with those in the west and north. If we regard the relative importance of the yield of the river fishing in proportion to the whole catch as an indication of the intensity of spawning, it would seem that relatively there is far more spawning in the south, but we also find that spawning results in a relatively far larger total yield as we proceed northwards.

1880—1906.

	Yield of River Fishing in kilos.	Yield of Sea Fishing in kilos.	Proportion between River and Sea.
Swedish Frontier to Jaederen . .	2,212,000	3,767,000	1—1·7
Jaederen to Stat	1,161,000	5,552,000	1—4·8
Stat to Russian frontier . . .	2,288,000	8,920,000	1—3·9

It is impossible without further information to say whether it is a fact that some of the fish which are hatched in the south go northwards when older, or whether it is that the southern fish return to spawn when they are younger and smaller, whereas the northern fish only return to spawn when they are older and heavier (and in this way each individual smolt would eventually give a larger result in weight). For the present this must remain an open question. It is most likely, after what we have seen, that both causes are operative, but, in any case, this remarkable geographic distribution of yield in our salmon fisheries has had new light throw upon it, and that, too, from a source which has not hitherto been available.

(e.) *Distribution of the Year-Classes.*

As I have stated previously, and as will be seen on examination of the tables in the Appendix, the smolts are not all of the same age, nor have they all spent an equal time in the sea when they return for the first time to spawn.

Some return sooner, others later, quite independently of the age at migration.

This circumstance is a matter of great importance to the general stock of salmon, as we shall see later.

In the following table I have arranged all the fish I have investigated from Christiansand, Trondhjem and East Finmarken in 1908 and 1909, according to district and year of birth.

When we examine the table carefully it is evident that the fish which we have to deal with in our fisheries in any one season, and of which the majority are on their way to the rivers to spawn for the first time* are born

* Fish with spawning marks are also included, but as was seen before, they are only a very small proportion—2 to 10 % of the total catch.

Locality.	Year.	Number Examined.	Of which the following number were born in						
			1906.	1905.	1904.	1903.	1902.	1901.	1900.
Christiansand .	1908	667	—	118	196	290	58	5	—
	1909	1,612	98	622	678	186	25	1	2
Trøndelagen .	1908	498	—	11	66	253	149	19	—
	1909	184	5	32	64	57	24	2	—
Øst-Finmarken	1908	87	—	—	11	22	39	12	3
	1909	284	—	1	17	121	112	28	5

in quite different years, and originate from a series of different spawnings the effects of which have been spread over six or seven successive years.

There has been a very widely-spread belief that the results of a successful smolt year or spawning year after the lapse of a definite interval of time—as to the length of which there were many different theories—would again show themselves in the form of a year of plentiful salmon or large catches. As can now be seen, the results of any one spawning—good or bad—are spread over the catches of six or seven years, and in such a manner that it seems improbable that we shall be able by means of statistics to show any remarkable difference in the effects of the different spawnings. In any case, in attempts to solve this problem we should have to reckon with so many doubtful points that the results would be most untrustworthy. A closer examination of the table shows this most clearly. Amongst other things it is at once evident that similar conditions do not prevail in the south and in the north, owing to the fact that in various years different year-classes constitute the bulk of the catch in different localities.

What, however, must at once strike one, is the remarkable manner in which this distribution of the product of each year's spawning must operate for the preservation of the species. When the results of any one spawning are spread over the catches of so many years, and when they are scattered so heterogeneously during different years throughout the various districts, it must in the highest degree tend to work as a sort of insurance for the species, and as a division of the risk attached to each individual fish.

CHAPTER III.

ON TROUT.

Anyone who knows the manifold variety of forms which trout may assume in Norway, and the immense number of streams and lakes with totally distinct conditions of existence in which they are found, will be aware of the impossibility of attempting a geographical classification of the age and growth of trout on similar lines to those we have followed in the case of salmon.

As a preliminary step, therefore, and merely as an introduction to the study of trout-forms, I decided to collect a number of examples for an initiatory comparison of characteristic forms to further a comparison of the stock in various characteristic localities.

In the first place I have endeavoured to obtain material which would enable one to make a comparison between sea-trout and fresh-water trout in their many "forms," such as burn-trout and trout from lakes where the fish "are not big," trout from "good" lakes where the fish are large, and finally the largest of all our trout forms the Mjøsen or "Hunner" trout. In the second place I have made an attempt to investigate the stock in waters to which both sea-trout and inland trout have access, and also at places where the fresh-water form only is found, and where access from the sea is impossible.

As I shall point out later, all the differences which lend themselves to demonstration may be reduced to variations in age and growth, and these differences vary very considerably in separate localities, while there may be intermediate stages of every sort and kind.

The old division into burn-trout, mountain trout, lake trout, etc., appears, therefore, of little use as a basis for discussion, nor would a classification according to growth and manner of growth be feasible without elaborate proof; I shall therefore confine myself to showing by means of some characteristic instances the results of my investigations, and afterwards, in a later chapter, deal with the growth and manner of growth of our salmonidae, and consider which types it might be possible to classify separately.

I have put down in tabular form in the Appendix only as much of my material as was necessary for evidence, and which was too voluminous to be included in the text.

A. *Instances of Sea Trout and of the Rivers to which they have Access.*

Sea trout, like salmon, spend the early years of their life in rivers or fresh-water lakes. The duration of their stay there, before migrating to the sea, varies just as it does for salmon, and the young smolts are not all of equal age.

This circumstance we can investigate in two ways.

We can investigate the age of the young fish that live in the rivers, and so get in certain cases an idea as to the duration of their stay there, but we are faced here with a complication. For whereas no salmon attain any considerable size before repairing to the sea, and as the females never, to my knowledge, develop their ova before they migrate to salt water, we find in many streams quite different conditions in the case of trout.

In many streams where sea trout are found, trout may be met with which attain considerable size and age and even maturity without having migrated to the sea, and it is often very difficult therefore to say whether we are dealing with the young of the sea trout, or whether the young fish we find do not also include the offspring of fish that have never repaired to the sea ; since by their outward appearance it is impossible to distinguish them.

The scales of the sea trout, however, show growth conditions resembling those of the salmon. In the river they develop slowly, in the sea extremely rapidly. We can accordingly, in most cases, detect the boundary line on the scale, which denotes the transition from poor to good growth, and we can note the number of winters which the fish has completed prior to migration.

As I did in the case of salmon, so also with trout I have endeavoured to obtain information by studying the scales with regard to the length of time which the fish have spent in the river previous to migration.

In Table XVII., I have put down the results of an analysis of 192 sea trout, taken from unsorted catches with the drag net that were sold to a fish dealer in Trondhjem on June 26 and 27, 1909.

This analysis has been worked out and arranged in the same way as was done on page 28 in the case of salmon.

If we take the results of this analysis, as regards age of migration, we get the following :—

Number of fish Examined.	Of these the Following had Completed previous to Migration				
	2 winters.	3 winters.	4 winters.	5 winters.	6 winters.
192	25	78	67	21	1

Here we meet once more with an age distribution similar to what we found to be the case with salmon smolts from the same district, that is to say, the majority are three to four years old when they repair to the sea.

The tables in my previous publication "Ørret og Unglaks" gave some interesting information as to the size of these sea trout smolts, as I measured a number of them when they were actually migrating from the rivers of the Trondhjem district in May and June. Their length varied between 10 cm. and 20 cm.

For purposes of comparison I have also made out the following calculation of the sizes of the young fish at the time of migration from measurements of the scales of the sea trout referred to in Table XVII. I selected in this connection the 118 fish which had lived one winter subsequent to migration.

Calculated Length in cm.	Number of Fish Examined.	Of these the Following had Lived previous to Migration			
		2 winters.	3 winters.	4 winters.	5 winters.
10	1	1	—	—	—
11	5	2	3	—	—
12	7	4	3	—	—
13	13	2	9	2	—
14	19	2	7	10	—
15	18	1	7	10	—
16	13	—	8	4	1
17	12	1	3	7	1
18	11	1	5	4	1
19	5	—	2	2	1
20	7	—	—	4	3
21	2	—	—	2	—
22	1	—	—	1	—
23	—	—	—	—	—
24	—	—	—	—	—
25	2	—	—	1	1
26	2	—	—	1	1
Total .	118	14	47	48	9
Average length in cm. .		13·1	14·8	16·8	20·1

From the above we see that the calculated lengths of the sea trout smolts range from 10 cm. to a little over 20 cm., being about the same extent of variation which I previously found in the actual measurements of smolts caught at the mouths of the rivers of the Trondhjem district, but we

can now classify the sizes according to the different age-classes which migrate. Each of these classes, as will be seen, has its own limits of variation, the average size invariably increasing with age.

It is also worth noting that some of the fish which migrated at a later period of life appear to have been of considerable size when they left the river for the sea.

If we now turn our attention once more to Table XVII., we find, as was the case in the corresponding tables for salmon, valuable information regarding the fish after its first journey to the sea.

It must be remembered that the table only refers to saleable fish. The limit below which fish are unsaleable is about 20 cm., so that the majority of the young fish which migrated in May and June for the first time in their lives are of course excluded. We merely get a few of the largest of them in the first group, *i.e.*, those which have not completed a winter after migration, and which consists of those sea trout that have just quitted the river. It follows that neither number nor average size in the case of these fish is of any quantative value for determining the total stock. On the other hand, the older groups (one winter, two winters, three winters, etc., after migration) are fully represented in the catches, and both numbers and sizes have therefore a definite value for determining the composition of the stock and the growth of the fish.

Summarising the information obtained from the table we get the following :—

	For the 174 Fish that had Lived after Migration			
	1 winter.	2 winters.	3 winters.	4 winters.
Number of fish	118	45	5	6
Average length in cm. . . .	30·1	38·8	47·7	55·7
Average weight in hectograms .	2·7	5·6	11	14·8

In the matter of the numbers of individuals in each age-class there is here much that reminds one of what we found in the case of salmon, The sea trout caught by the nets consist mainly of fish that have lived from one to four winters subsequent to migration, fish of higher ages occurring only exceptionally. At any rate, in my search for large sea trout I have rarely met with individuals that had attained greater age.

What value must be ascribed to the relative distribution of the whole stock among these four age-classes is another question. It is quite probable that other samples may show higher figures for the older classes, Still I feel quite convinced that the older classes are generally characterised by a diminishing number of individuals. The bulk of the sea trout brought to

market in Norway are always about 20 cm. to 40 cm, in length, as can be verified by examining all the measurements made in this country.

In order to form an idea as to how the general stock in the Trondhjemfjord compares with the examples taken from the catches of the fishermen referred to in Table XVII., I have made the following summary of my catches in that district during the years 1898—1900, which was published in tabular form in *Ørret og Unglaks*.

The summary indicates that the larger and older sea trout occur in relatively small numbers, and that the figures given in Table XVII., rather over-estimate than under-estimate the frequency of the larger and older fish.

Length in cm.	Number of Fish in Dahl's Catches 1898—1900.	Number of Fish investigated in Table XVII.
10—20	563	—
20—30	659	81
30—40	118	85
40—50	39	20
50—60	8	5
60—70	—	1
Total	1387	192

Interesting information with regard to growth is also given in our summary on page 56, and more especially as regards the figures for length and weight of fish which had completed one and two winters after migration. These figures are based on so large a number of observations that they may be accepted without reserve. The values for fish that had lived three and four winters after migration may be less convincing, but they give a tolerably sound indication of the rate of growth.

As regards the growth of sea trout in other parts of the country, I have as yet but little information, and it is quite possible that the growth may differ to some extent in different localities.

The only place from which I have any material which admits of comparison is Utskarpen in Ranenfjord (see Table XIX.) and comparing the figures we get:

	Average Length in cm. of Fish which after Migration had Lived			
	1 winter.	2 winters.	3 winters.	4 winters.
Trondhjem Fjord, June 26th—29th	30·1	38·8	47·2	55·7
Utskarpen, Ranenfjord September 1st—10th	33·3	41·4	—	—

Remembering the fact that these samples from Utskarpen have been taken two months later in the season than the samples from the Trondhjem-fjord, and also in a different year, we are entitled to say that the average lengths are in fairly close agreement. Consequently if the growth is so similar in districts so remote from one another, we are justified in assuming that these values are fairly characteristic, at any rate for the northern parts of the country. This assumption, moreover, is confirmed by various small samples which I have occasionally had the opportunity of examining.

How matters stand in the south I have not yet sufficient material to say, though a few samples from the Os river near Bergen and from the Søndeled river at Risør show no essential difference from what I have described in the case of the northern streams.

With regard to maturity in sea trout, both prior to and subsequent to migration, our sample from the Trondhjem-fjord unfortunately does not tell us anything, since we were unable to make the necessary examination of the fish.

I have, however, obtained valuable information from a large sample obtained from Utskarpen in Ranen.

In Tables XVIII. and XIX., I have made an analysis of the samples that were taken between 1st and 10th September, 1907, partly in the Dalos river at Utskarpen and partly in the sea at the mouth of the stream.

Table XVIII. includes all the fish which were caught in the Dalos river, and which, both by their appearance and from the structure of their scales, may be said never to have quitted it.

The table shows us that it is only exceptionally that the river contains fish which are more than six winters old, and which have not been to the sea. Consequently we are dealing here practically solely with those age-classes which characterise the sea trout smolts. Their size, too, as we notice, varies between 10 cm. and 25 cm., exactly what was found to be the case with the migrating sea trout in the Trondhjem-fjord.

By means of the table we can make out the following summary of sex and maturity in relation to age.

Age in winters.	Number of Fish September 1—10, 1907.			
	♂		♀	
	Mature.	Immature.	Mature.	Immature.
2	—	12	—	9
3	—	9	—	16
4	3	1	—	1
5	5	—	—	—
6	3	—	—	—
9	1	—	—	—

It will be noticed that there are no mature fish among any of the individuals which are only two or three winters old, and that males and females occur in about equal numbers. It is only in the older groups, from four winters upwards, that we meet with maturity, and these mature fish are, without exception, males. The older females have migrated. Thus we meet here with conditions quite analogous to those we found in the case of salmon parr so far as maturity and sex are concerned. The table shows us also that this river does not contain any other trout than sea trout, since no stock could last which depended solely on spawning males. If fresh water trout or stationary trout existed side by side with the sea trout we should be sure of the fact by a relatively plentiful occurrence of mature females.

The fish in the Dalos river, therefore, which have not been to the sea, are merely the young progeny which have not yet migrated, and of which only the oldest males are mature, and the supplement of the stock is to be found by examining the fish, which have evidently been in the sea, and which are given in Table XIX.

By means of this table we can draw up the following statement of sex and sexual characteristics, in relation to the number of winters which the fish had completed after migration.

Winters after Migration.	Number of Fish September 1—10, 1907.			
	♂		♀	
	Mature.	Immature.	Mature.	Immature.
0	6	11	—	20
1	10	7	3	9
2	4	2	8	—
3	—	—	1	—
4	1	—	—	—

This shows us in the first place that the number of males and females in the corresponding stages of existence is fairly equally balanced. Here, too, the males are the first to begin spawning, as some of them spawn after merely one summer in the sea. After a stay of one winter and more in the sea the proportion of both males and females which spawn is increasingly augmented, though in each age-class there are still some that do not participate. It is not until we reach the oldest stages that we find that all the fish enter the river to spawn.

In Table XX., I have endeavoured to illustrate this state of affairs

still further by comparing the aggregate age of trout that have never been in the sea and of sea trout. The comparison works out as follows:—

Aggregate age in winters.	River Fish.		Sea Fish.	
	♂	♀	♂	♀
2	12	9	—	2
3	9	16	1	4
4	4	1	17	11
5	5	—	16	12
6	3	—	6	9
7	—	—	—	4
9	1	—	—	—

Two things are clear from this. In the river the number of individuals decreases as we approach the maximum age of migration. In the sea it increases from the minimum age of migration and decreases as we approach the limit of the fish's life.

The absence of females in the later year-classes in the river is evidently due to the fact that they have migrated.

Consequently the stock of fish that have never been in salt water and the stock of fish that have migrated are supplementary to each other.

Similar conditions are met with in many of the streams to which sea trout have access. If we examine the stock of fish that has never been in the sea, we find that in many places males and females often occur in equal proportion in the youngest year-classes, whereas the older year-classes consist mainly, and at the end exclusively, of males. This must be regarded as a sure sign that the stream in question chiefly contains fish that will become sea trout.

In many places, however, this is not so obvious, and in some streams to which sea trout have access, we may even find that the proportion between males and females is only slightly affected by age, and that spawning females occur which have never migrated.

Instances of such streams are Aagvand in Rødøherred, Nordland (see Table XXI.), Kvernvand in Naerø, Namdalen (see Table XXII.), Mølnbugtselv in Agdenes (see Table XXIII.), and the Os river near Bergen (see Tables XXIV.—XXVI.).

From these tables we are able to obtain the following comparison:—

Locality.	Number of Fish Examined.	Number of Fish which have Lived													
		1 winter.		2 winters.		3 winters.		4 winters.		5 winters.		6 winters.		7 winters.	
		♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀
Aagvand . .	44	—	—	1	6	13*	9*	10*	2	2*	—	—	—	—	—
Kvernvand . .	95	—	—	13*	14	12*	34*	4*	15*	—	3*	—	—	—	—
Mølnbugtselv .	62	6	7	18*	21*	2*	1	4*	1*	2*	—	—	—	—	—
Osvasdraget 1 .	55	—	—	1	4	15*	11*	8	9*	3	1	2	—	—	1
Do. 2 .	155	4	—	37	36	32	13*	16*	8*	5*	4*	—	—	—	—
Do. 3 .	132	5		29	21	23	21	14*	12*	4*	4*	—	—	—	—

* Denotes that mature fish occurred in that particular year-class.

Here we see in the first place that the proportion between males and females varies greatly in different localities.

In Aagvand and Mølnbugtselv we find the typical decrease in the age of females mentioned in the case of Utskarpen.

In the Os river the samples have been taken from a succession of catches from the mouth of the river and up stream, and numbered respectively 1, 2, and 3. Here, again, nearest the mouth, we find the typical absence of older females, whereas the higher up the river we go the more numerous do they appear to be.

The proportion between the sexes is reversed, however, in Kvernvand. Here there are peculiar conditions owing to the out-flow being a very small burn, which is dry for a great part of the year, and the fish consequently are only able to ascend and descend when there is a spate, and I am compelled to state in this instance that I can only accept with considerable reserve the proportional number of individuals of the two sexes in the sample, as the writing of my amateur assistant at the examination has proved liable to misinterpretation.

The next point to notice, from the figures marked with *, is that mature individuals may occur as early as the third, or sometimes even the second year, and that maturity is not confined to males, mature females also occurring.*

A third point is that the maximum age for fish in these streams only rarely exceeds the maximum age at which sea trout migrate, and the numbers of individuals in the year-classes decrease, too, at a more or less rapid rate, as we approach this maximum age. There is thus nothing in this connection to prevent us assuming that this decrease is connected with migration. That it is due to migration, so far as a large part of the stock

* In the case of the Os river my investigations took place so early in the year that it was only in a few instances we could decide with any degree of certainty whether maturity had commenced.

is concerned, is obvious enough; whether, however, the spawning females take part in this migration at a later period of their existence, or whether their lives terminate more quickly here than in land-locked lakes, where the fish attain considerably higher ages, is not easy to decide.

This much, however, we can be positive about, that these streams to which sea trout have access, contain a stock, which mainly consists of young fish, and it is very probable that the whole of this stock of young fish contribute towards the recruiting of the stock of sea trout. This is, too, the most likely reason why we so seldom find older fish in these waters.

With regard to rate of growth the conditions vary a good deal. I will set down here once more in tabular form the empirically found average sizes of trout in the waters referred to. They are taken from the tables already mentioned (Tables XXI.—XXVI.).

Place and Date.	Average Length in cm. of Fish that had Lived				
	1 winter.	2 winters.	3 winters.	4 winters.	5 winters.
Aagvand, August 12, 1908 .	—	11·0 (7)	16 (22)	20·8 (12)	—
Kvernvand, July 6, 1909 . .	—	19·1 (27)	22·5 (46)	25·6 (19)	30·3 (3)
Mølnsbugtselv, July 4, 1909 .	13·6 (13)	19·3 (39)	22·3 (3)	25·8 (5)	30·5 (2)
Os River, May 19, 1909 . .	9·5 (4)	13·9 (73)	17·7 (45)	20 (24)	22·8 (9)

The number of observations on which each average is based are added in brackets.

B. *Instances of Trout from Waters to which Sea Trout have no Access.*

1. Lake Mjøsen Trout.

We will first consider examples of the large trout which live in Lake Mjosen, and which in summer and autumn ascend the river Laagen to spawn. They are fished for in that stream under the name of "Hunner Trout," a name derived from the old fishery at the farm of Hunner.

Herr Sogaard, of Lillehammer, has been kind enough to allow one of his employees to collect samples of scales from the trout which passed through his shop from the end of June to the beginning of September. The collection represents 171 fish, all taken in the Laagen above Lillehammer.

In Tables XXVII. and XXVIIb. I have put down the results of my analysis in the same way as I did in the tables for salmon previously described. Table XXVII. contains an analysis of age in relation to length, and Table XXVIIb. deals with age in relation to weight.

The tables are arranged in such a way that the age of the fish, previous to and subsequent to migration is shown, but the statistics of size are given subsequent only to migration.

On examining the scales the reason for this arrangement will be evident. If we look at Fig. 23 (Plate VIII.), which represents the scale of one of these trout, nine winters old, we are at once struck by the sudden change in growth which occurred after the fourth winter. From the beginning of growth up to that period development must have been comparatively small, but in the following period of growth its development has been extremely rapid. Similar conditions were shown by the scales of all the fish in the sample, with perhaps one or two exceptions, as will be seen from the figures in Table XXVIIc.

This table contains the calculated lengths of every fish on the completion of each winter-band (the calculations have been made in the manner previously described—by measuring the growth-zones of the scales).

On looking through the series of figures for each individual it will be seen that in every case the fish had, after a shorter or longer period of adolescence with relatively poor growth, experienced a sudden change in development.

I have not investigated the younger stages of Mjøsen trout. Still, as the fish spawn in the Laagen, and the young trout undoubtedly live for a long time in this river before migrating to the lake, I have felt myself justified in considering this alteration in the rate of growth as an indication of the time at which—analogous to salmon and sea trout—they left the river and repaired to the richer waters of the lake. It is, moreover, immaterial whether we call the boundary line between the two periods of growth, one of migration, or one of change of growth. The main point is that we can sufficiently clearly distinguish this division and determine the duration of the two periods.

We shall now proceed to consider what the tables teach us.

From Table XXVII. we obtain the following figures relating to the age at which migration or change of growth takes place :—

Number of Individuals Examined.	Of these the following at the Time of Migration or Change of Growth had Completed			
	3 winters.	4 winters.	5 winters.	6 winters.
171	2	65	85	19

Here we find that migration or change of growth does not take place in every instance at the same age, which is precisely what we discovered in the case of salmon and sea trout. In some fish it begins early, in others later, and so, too, the table shows us that the majority appear on the whole to be older than salmon and sea trout at the time when this change

of growth takes place. A comparison of the corresponding tables for salmon and trout will make this clear (see pages 31 and 54).

With regard to the size which the majority attain previous to migration, I cannot speak from direct experience, seeing that, as already stated, I have not examined any young fish ; the calculated sizes set down in Table XXVIIc. allow us, however, to form a fairly reliable idea of the facts. By availing ourselves of the values denoting what length each trout was when the last winter-band was formed previous to migration, we get the following result :—

Length in cm.	Number of Fish which at the Time of Migration or Change of Growth had Lived			
	3 winters.	4 winters.	5 winters.	6 winters.
18	1	—	—	—
19	—	—	1	—
20	—	3	—	—
21	1	5	—	—
22	—	4	2	—
23	—	8	2	—
24	—	10	5	1
25	—	14	7	1
26	—	8	9	—
27	—	5	10	2
28	—	3	8	2
29	—	1	10	—
30	—	2	8	5
31	—	—	8	2
32	—	—	5	1
33	—	—	1	1
34	—	—	3	3
35	—	—	1	—
36	—	—	—	1
37	—	—	—	—
38	—	—	1	—
Average length in cm. . .	19·5	24·2	28·1	30·2

The length, therefore, varies between 18 cm, and rather more than 30 cm., and these fish are accordingly, when transition to larger growth takes place, considerably larger than either salmon or sea trout. The sizes of the different age-classes have each their range of variation, which advances with age, as does also the average length of the fish.

On again examining Table XXVII. we find all the information we need regarding the age and growth of Mjøsen trout subsequent to migration. I have put in brackets the fish whose scales had spawning marks. In the Chapter on "Methods" I mentioned that these spawning marks in trout do not seem to occur with the same regularity as they do in salmon. As, however, the surface of trout scales is comparatively small, it often happens that the spawning marks cannot be deciphered with any degree of certainty. Consequently I have not ventured to draw up an analysis of trout with spawning marks as a means of determining the average length and weight. The average length and weight has accordingly been based solely on the investigation of those scales which did not possess any spawning marks. On the other hand, when investigating the question of age, I have noted in brackets the fish with spawning marks, and it is therefore possible that the age in some cases may be slightly underestimated.

If we now sum up the information we have obtained from Table XXVII. we get the following comparative statement:—

	Fish which after Migration or Change of Growth had Lived									
	1 winter.	2 winters.	3 winters.	4 winters.	5 winters.	6 winters.	7 winters.	8 winters.	9 winters.	11 winters.
Number of fish.	6	11	55	58 (2)	10 (4)	8 (5)	2 (2)	3 (3)	(1)	(1)
Average length in cm. . .	46·5	55	62	69·7	77·5	84·1	92·5	93·3	—	—
Average weight in hgv. . .	11·7	18·9	28·1	41·9	59·0	81·1	93·5	99	—	—

What chiefly strikes us in this statement is that we are dealing with fish which attain a much higher age after change of growth than either salmon or sea trout. While in the case of these latter, one rarely meets with fish which have lived more than three or four winters after migration, or change of growth, the Mjøsen trout attain to far higher ages. No doubt the number of individuals decreases with advancing age, still there must be quite a considerable proportion of the stock which are of great age.

The average lengths and weights of the different year-classes teach us that growth is vigorous even at a very high age, and the ultimate lengths and weights of Mjøsen trout resemble the values characteristic of salmon which have spent three winters in the sea.

The scales of Mjøsen trout, moreover, exhibit a peculiarity which is much more pronounced than in any other district in Norway which I have investigated, though probably it will be found to occur in many other inland waters. If we look at the scale depicted in Fig. 23 (Plate VIII.) we notice that the last winter-zone lies very near the edge. When the fish was caught

on August 19, it could not have been long since its winter-growth and the formation of the winter-band was completed.

Exactly similar conditions appeared in all the scales I examined, as may be seen by referring to Table XXVIIc. If we examine the various individuals in this table, we frequently notice that the increase of length acquired by each fish since the last completed winter was very small compared to the total increase between that and the previous winter.

As an instance we will take No. 38, caught on July 30. Its course of life has been as follows :—

No. 38. Measured Length on July 30.	Calculated Length at Completion of Winter-band.							
	1	2	3	4	5	6	7	8
60 cm.	5·5	10	17·5	21·5	26·0	39·5	49	58·5

Thus during its last summer the increase in growth only amounted to 1·5 cm., whereas between the formation of the seventh and eighth winter-zones it had grown 9·5 cm.

Exactly similar conditions appear in all the specimens, and we may therefore conclude that summer-growth in Mjøsen begins late. This is very probably due to the somewhat remarkable conditions of temperature prevailing in this lake. Its main source of supply, the Laagen, brings down a great deal of icy water until late on in the summer, and it is therefore late before the waters of Mjøsen begin to rise in temperature.

The temperature records published by Herr Hvitfeldt-Kaas* show this clearly. I give as an example the following from his series of records for the year 1909 :—

Depth in m.	Date and Temperature + C°.						
	March 11.	April 18.	June 6.	July 18.	September 10.	October 15.	November 18.
5	0·60	1·40	4·65	12·50	12·70	8·30	5·80
10	1·10	1·40	5·60	12·40	12·50	8·00	5·80
20	1·75	1·85	4·10	5·90	10·50	7·60	5·80
50	2·85	3·00	4·00	4·50	5·40	7·30	5·40

From these figures it is evident that the rise in temperature of the upper surface of Mjøsen is late, and that by way of compensation it is also late in cooling down. Thus the greatest warmth is in September, and even

* "Temperaturmessungen in dem See Mjøsen," etc. Archiv f. Mathm og Naturv. Vol. XXVII., n. 2, 1905.

in November it is warmer than in June. These circumstances would lead one to imagine that we have here the cause of the late start in growth of the trout in this lake.

2. Trout from Other Lakes.

The material which I have obtained from other lakes and streams consists in the first place of some large samples from different localities. From these I have been able to compile comparative figures of the relative size in relation to age.

I have, further, a series of smaller but carefully selected samples, which have been treated according to the methods of investigation and measurement described on pages 23 and 25, and the values thus obtained enable one to estimate the average lengths which the fish at the place in question usually attains on the completion of its first, second, third, etc., winter of existence.

The values we get in this way, as I have described at length on the pages referred to, are sufficiently exact for purposes of comparison.

Let us first consider three large samples which are respectively from Krokaa, Chaigijok above Rasti Lombola, and from Sandvand.*

Samples from these waters have been dealt with in Tables XXXIII., XXXIIIb., XXXIV. and XXXV., from which we obtain the following:—

Locality.	Number of Fish Examined.	Number of Fish which had Completed										
		1 winter.	2 winters.	3 winters.	4 winters.	5 winters.	6 winters.	7 winters.	8 winters.	9 winters.	10 winters.	11 winters.
Krokaa .	110	—	5	13	34	48	10	—	—	—	—	—
Chaigijok .	108	—	9	6	34	34	18	5	2	—	—	—
Sandvand .	115	7	4	7	24	39	22	5	2	3	1	1

Here we see that in all the samples we get relatively few of the youngest year-classes, principally because they are too small to take a hook; and, again, another noteworthy point is that the numbers increase with age, to decrease once more as they approach the maximum age. This decrease

* Sandvand on the mainland, a little south-east of Harstad, is a lake about one kilometer in length and 500 metres wide at its broadest part. It lies at a slight elevation above the sea, though sea fish are unable to get right up to it.

Krokaa is a small river or rather a large burn which flows through a mountain valley into Skilbotten at Bronnoy in Sondre Helgeland. A high perpendicular waterfall about 100 metres from the sea prevents sea trout from ascending it.

Chaigijok. The main source of Ovre Laksvand, Lakselv, Finmarken. Rasti Lombola is a lake-like expansion in the lower sluggish portion of Chaigijok.

may be due to several causes. On the one hand, it may be ascribed, perhaps, to insufficient material, though with waters so simple in character as Chaigijok and Krokaa this is not a matter of much consequence. On the other hand, it may possibly be due to matters connected with migration and mortality.

A third point of interest is the relatively small maximum age in such small streams as Krokaa.

As will be seen below in the statement of the average sizes of fish at different ages, this is different in all three places, though there is most resemblance between Krokaa and Chaigijok, where growth is slow. In waters like these, where development is so tardy, it is sometimes difficult to decipher the scales of the older fish, and it is possible, accordingly, that we may occasionally assign too low an age to some of them.

Locality.	Date.	Average Length in cm. of Fish that had Completed										
		1 winter.	2 winters.	3 winters.	4 winters.	5 winters.	6 winters.	7 winters.	8 winters.	9 winters.	10 winters,	11 winters.
Krokaa .	July 21—Aug. 8, 1907.	—	12·4	14·2	17·3	19·1	21	—	—	—	—	—
Chaigijok.	July 15—20, 1909.	—	12·3	15·5	17·4	19·7	22·3	25	25	—	—	—
Sandvand	August 3, 1909.	13·9	15·5	20·6	24·6	28·9	32·2	34·6	40·5	46	47	49

But this can hardly be of any great consequence, since the scales of many of the oldest fish are quite easy to decipher, and are without the thickened, irregular edge which characterises the scales of fish whose growth has practically stagnated.

A similar low maximum age was apparent in almost all the lakes and streams which I have investigated in which the fish did not run large.

We may take as an example the sea trout streams, which I have previously described, where we found a short term of existence (or residence) combined with relatively poor growth. In these we ascertained that in certain cases migration could clearly be assigned as the cause of the low maximum age, and the same reason may also to some extent be effective in the small inland waters where there are young, slowly-growing fish.

Most of the waters where growth is more vigorous are characterised also by older fish.

In the accompanying table I have compared the calculated mean values of the lengths of the fish in a number of lakes and streams.*

We can thus compare directly the length of fish of identical age from

* See Tables XXVIII., XXIX., XXX., XXXI., XXXII., XXXIVB., XXXVB., XXXVI., and XXXVII.

different localities, and I have for the same reason added the calculated values for Chaigijok and Sandvand.

These values show us that the growth of the trout in the first three or four years of its existence agrees pretty closely in the many different localities. It would appear that it is in the succeeding periods of its life that a wider difference occurs. For instance, if we look at the values of fish that are six, seven, and eight years old we notice how great is the discrepancy in their growth. And this is even greater when we consider the difference in weight relatively to the difference in length.*

As regards the rate of growth, we find precisely the same conditions ruling that we found in the case of Mjøsen trout. All the fish, whose scales indicate a high age, had grown continuously throughout the whole of their lives.

The trout of these inland lakes also furnish examples of the same peculiarity that we found in the case of salmon, sea trout, and Mjøsen trout, namely, that after a period of youth, with relatively slow growth, the fish enters into a later period with far better growth. In connection

* In Table XXXVIII., I have given an analysis which enables the reader to find the average weight of each trout of given length. The analysis is based upon the average of a large series of weights and measurements of trout from different localities. There is probably some local variation in the relation between length and weight, and the analysis cannot therefore claim absolute accuracy for each locality, but it is merely meant to serve as a general guide.

Calculated average Length in cm. of the Growth of each Winter-zone.

		1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.
Hardanger-Vidden.	Lasgen above Holen	4·6 (7)	9 (7)	12·8 (7)	17·9 (7)	20·4 (5)	22·6 (4)	26·3 (2)	30·5 (1)	— (8)	— (8)	— (1)	— (1)	— (1)	— (1)
	Holen	5·3 (20)	9·2 (20)	12·8 (20)	16·2 (20)	20 (20)	23·9 (19)	27·3 (19)	30·7 (18)	34 (8)	35·7 (8)	39·3 (1)	42·3 (1)	46·2 (1)	47·9 (1)
	Lasgen below Holen	4·8 (7)	9·3 (7)	14·2 (7)	17·8 (7)	21·2 (7)	23·2 (2)	25·4 (1)	28·3 (1)	— (8)	— (8)	— (1)	— (1)	— (1)	— (1)
	Djupe	5·4 (9)	10·1 (9)	14·3 (9)	18·6 (9)	22·6 (9)	27·2 (8)	30·5 (7)	35·8 (5)	38·1 (2)	39·7 (2)	— (1)	— (1)	— (1)	— (1)
	Osfjorden	7·4 (6)	11·4 (6)	16·1 (6)	20·9 (6)	26·3 (6)	32·9 (6)	38·7 (6)	45·6 (6)	51·2 (6)	56·7 (3)	58 (2)	60·2 (2)	— (1)	— (1)
Nordland.	Sandvand	4·9 (115)	8·9 (108)	13 (104)	18·4 (96)	24·6 (73)	30·5 (34)	36·2 (12)	41·7 (7)	44·4 (5)	46 (2)	48·2 (1)	— (1)	— (1)	— (1)
Lakselvdalen. Finmarken.	Chaigijok	4·9 (108)	9·5 (108)	13·2 (99)	16·4 (93)	18·6 (59)	21·4 (25)	23·8 (7)	24·2 (2)	— (9)	— (7)	— (1)	— (1)	— (1)	— (1)
	Luostijok	4·4 (15)	9 (15)	12·6 (15)	16·3 (15)	20·5 (15)	23·8 (14)	24·6 (10)	30·6 (10)	35·3 (9)	39·7 (7)	41·2 (3)	— (1)	— (1)	— (1)
	Gagavand	5·3 (10)	10·1 (10)	15·7 (10)	19·3 (10)	23·4 (10)	28·9 (9)	34·1 (5)	46·5 (2)	60 (1)	64·5 (1)	— (1)	— (1)	— (1)	— (1)

The number of observations are given in brackets.

with this point it is remarkable, as was noticed before, that in the early stages of the trout's life there is remarkable similarity in the rate of growth in different localities, and that the differences only appear at a later period of life.

The fish in Sandvand, for instance, exhibited a typically altered mode

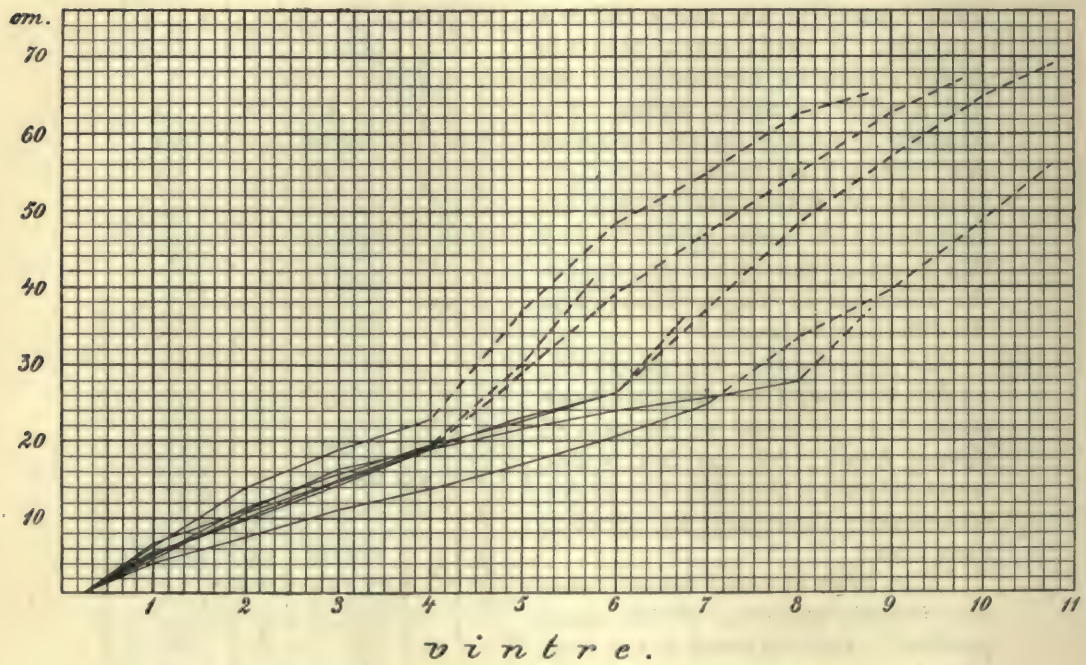


FIG. 30.—Growth Diagram of Seven Trout from Gjeddevand.

of growth of the kind described, as will be seen if we examine the figures in Table XXXIVB.

As a very instructive example I will mention seven trout I have obtained from a little lake in Finmarken.

Close by the river Luostijok, whose stock I have previously described, lies a little moorland lake called "Gjeddevand." It is separated by a small strip of land from the Luostijok, and its only source of supply is when the river now and then overflows its banks, and some of the flood water enters it by way of a shallow depression. The lake contains quantities of perch, pike, and burbot (*lota vulgaris*). There are, in addition, considerable numbers of very large trout, and so large that the Finns have to use salmon nets for their capture. As no streams flow into this lake, and the bottom is all mud, it is impossible for the trout to propagate there, so that the stock

is dependent on such fish as chance to enter it from the Luostijok during a flood.

The seven fish which I have obtained from this lake have been used in drawing up Fig. 30, in which the growth curves for each of the trout are shown. The unbroken lines of the curves denote the period of slow growth, and the dotted lines show when growth was rapid.

The values from the Luostijok are, according to the comparative statement on page 69, as follows :—

Calculated Average Length in cm. at Formation of each Winter-band.

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
4·4	9	12·6	16·3	20·5	23·8	24·6	30·6	35·3	39·7	41·2

Now if we consider the curves in Fig. 30 in relation to these figures, it will at once be seen that each single fish, at the period of transition from slow to rapid growth, was of a size resembling the corresponding sizes from the Luostijok, and that the average values for the unbroken parts of the curves agree very closely with the average values from that river. On the other hand, each single fish in the lake, after change of growth, has developed much more rapidly than the fish which remained in the Luostijok.

There is not much doubt, then, that these trout have spent their youth in the Luostijok and entered the Gjeddevand during a flood, and have found there quite different conditions of food from what they were accustomed to in the river. Whatever their origin may have been, the fact remains that their growth history is clear evidence that these inland trout possess the same faculty of developing great changes in their rate of growth, as we found to be the case with salmon, sea trout, and Mjøsen trout.

They also furnish clear evidence as to the difference which may occur in growth even in closely adjacent localities, since the land dividing Gjeddevand from the Luostijok ver is not more than about 10 metres broad.

CHAPTER IV.

GENERAL CONCLUSIONS AS TO THE PROBLEMS CONNECTED WITH THE GROWTH OF SALMON AND TROUT.

I SHALL now conclude by comparing the growth and manner of growth of the different fish described in the preceding chapters.

In the accompanying figure (Fig. 31) growth-curves are shown for Salmon, Sea-trout and Mjøsen trout of the same migration age. Included too, in the scheme, are curves representing a slow-growing trout (from Chaigijok) and a rapidly growing mountain trout from Osfjorden in Dagali, Numedal.

It will be evident at once that the diagram illustrates very different growth and modes of growth. Still more dissimilarity would have appeared, however, if I had depicted several out of the many trout-curves, but I considered it inadvisable to do so, for fear of making the diagram too intricate.

We see, then, that salmon in their early stages have perhaps the slowest growth of all; the Mjøsen trout grow relatively better than most of the trout family, and their development after change of growth most nearly resembles that of the salmon.

The sea-trout after change of environment grows rather less rapidly than the Mjøsen trout.

Finally, in the curve for mountain-trout from Osfjorden, we meet with a growth which is regular and vigorous throughout the fish's whole existence, and in the burn-trout from Chaigijok we see the representation of a fish that grows regularly but poorly during a great number of years.

These curves must not, however, be considered as absolute in every case. Indeed they do no more than represent a definite kind of growth in salmon, sea-trout and Mjøsen trout, for every one of which it would be possible to set up a number of subordinates, such as, for instance, curves for the three, four, five, and six-year-old migrants, or curves for their different localities in the case of sea-trout and salmon.

We see accordingly that in conjunction with each of the type-curves shown there might be put down a number of others, which would still further emphasise the variations in rate of growth shown in the examples here illustrated.

The diagram shows clearly that the old problems regarding the variability of fish, so far as this is expressed by size, may be reduced to the

two factors of age and growth, that is to say to difference in age and difference in growth; and we have now the advantage of being able to demonstrate in every case, with certain limits, what the difference consists in, and can resolve the variation into its several elements.

Any attempt to group the different "forms" within definite classifications on the basis of growth, will, in my opinion, at any rate with the insufficient material we possess, be impracticable, owing to the variations in rate of growth which present themselves.

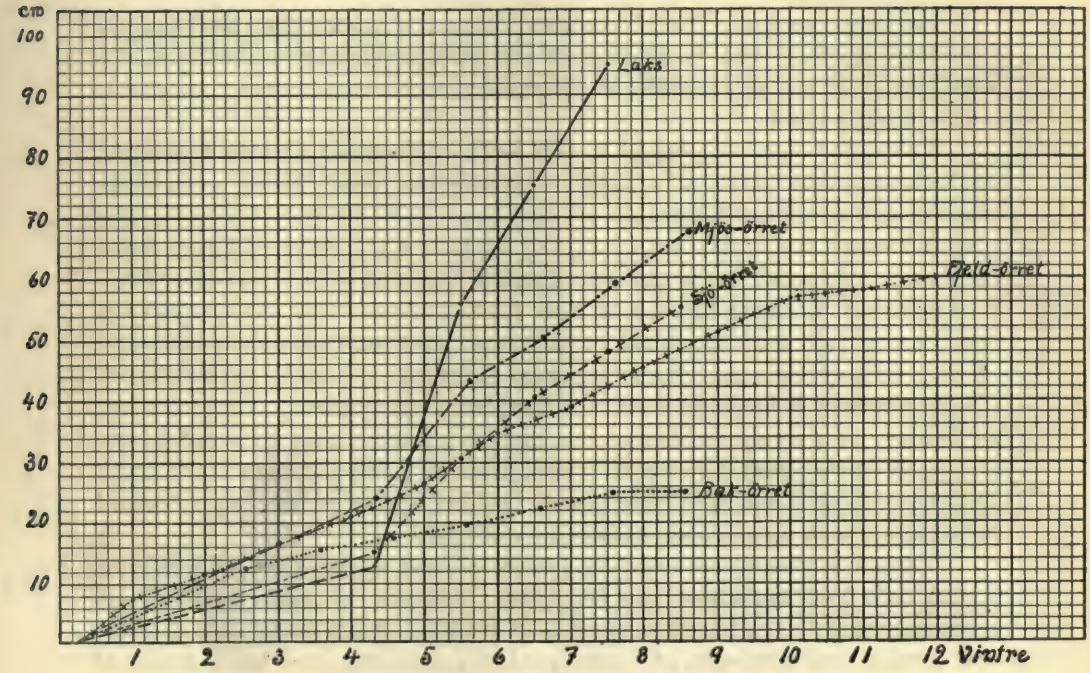


FIG. 31.—Diagram showing Growth of Salmon and Different Trout.*

It would therefore appear that so far as our present information goes, we cannot place reliance on anything but the manner of growth. We have seen in all our investigations that the fish grow in two manners. Either they have a regular consistent development, vigorous or poor, throughout the whole of their lives, or else, like salmon, sea-trout, Mjøsen trout, and many other fresh-water trout, they change suddenly from a more or less poor form of growth to a totally distinct and more rapid growth under more favourable conditions of existence.

* Laks = Salmon, Mjos-orret = Mjøsen trout, Sjo-orret = sea-trout, Fjeld-orret = mountain trout (from Osfjorden), Bak-orret = Burn-trout (from Chaigijok).

It is possible, therefore, to divide the fish into two classes, according to their manner of growth.

1. Fish with uniform development (trout-like growth).
2. Fish with altered development (salmon-like growth).

A classification of this sort is perfectly feasible, and it will be both useful and instructive, inasmuch as it will always convey valuable biological information as to whether the fish had spent all its existence amidst uniform conditions, or has been subjected to very considerable alterations in its surroundings.

Our investigations, then, have won for us this advantage: that the old question regarding the variability of the salmonidæ may be reduced to a mere matter of age and growth, a difference that we are in every case able to throw light upon.

When, however, we proceed to ask about the causes of this difference, we find ourselves often at a loss. One may naturally enough conclude that the extraordinary alteration in development which we observe in the growth-history of salmon, sea-trout, and several other sorts of trout, must be closely connected with change of residence and access to better food. But it would be short-sighted on our part to assume that the quantity of food is the only deciding kind of influence that regulates the course and rapidity of development. Growth is by no means a simple phenomenon. On the contrary, it is the product of influences of many kinds. Undoubtedly, as I have previously mentioned, food plays an extremely important part, and possibly the most important. Still, even in this particular factor there are many variations, and there are, besides, quite a number of other influences whose significance cannot be disregarded.

We can, for instance, mention quality of food, opportunity of obtaining appropriate food, variation in temperature, duration of winter (with which is connected the duration of the period of growth), the chemical composition of the water, the influence of topographical conditions, and the number of the stock. Last of all, there is the old question of race.

Even if we can demonstrate that the old problem regarding variability, in so far as it is expressed by size, may be reduced to differences of age and growth, we are still faced with the possibility that underlying the great plasticity in growth which we have observed, there may be concealed a difference in race, a hereditary difference, showing itself by a more or less pronounced tendency to rapid development, or, if one may say so, a greed of greater or lesser degree, by which is implied a greater or less power of absorbing and utilising food or conditions of existence.

Many other influences might be mentioned, but it is as well to confess that we are, on the whole, not in a position to judge of their importance, or to assert positively what part they play.

As a remarkable instance I will mention Carl Semper's well-known experiments with a species of snails, by means of which he demonstrated that the young of a particular kind of snail, Limnea Stagnalis, even though all other conditions of growth were identical, exhibited a widely differing development which corresponded to the volume of water with which each individual was supplied. When the supply of water exceeded a certain volume this difference ceased, and Semper explained this by the hypothesis that the water must contain some ingredient favourable to the growth of the snail, but that a certain volume of water was essential to ensure that this ingredient was there in sufficient amount.

It is not impossible that fish may be similarly affected.

I will also, by way of illustrating another peculiar example of the existence of different influences, describe what I invariably found during my investigations of salmon and trout.

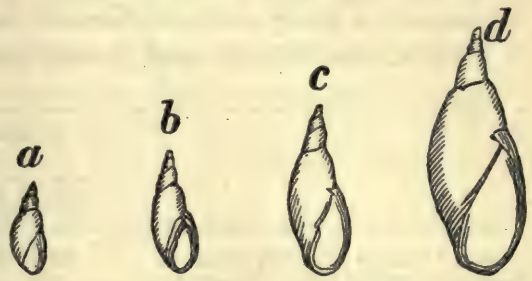


FIG. 32.—Relative size of snails, derived from the same cluster of eggs of the same age, and reared: *a*. in 100 ccm., *b*. in 250 ccm., *c*. in 600 ccm., and *d*. in 2000 ccm. of water per individual. (From Semper.)

The reader will perhaps remember that in all fish which have undergone a considerable change of growth, this alteration occurs at no particular age, and that the time at which it takes place (the migration age) varies. If, for example, we take fish which have lived for the same number of years after migration and group them according to their migration-age, that is to say, the age when change of growth commenced, and if we compare the development of each of these groups, we shall find one striking fact generally in evidence. The material in my tables is not always large enough for the necessary comparison, but in the one which follows I have selected some examples, and a reference to the tables will in any case show that wherever the size of the material is sufficient this condition of affairs is nearly always to be seen.

The table, then, indicates that it is a matter of great importance for the growth of a fish subsequent to migration, whether it has migrated at a quite young stage or at a later period of life. The oldest migrants have clearly quite outdistanced the younger ones in growth during the course of the same period of time. They have acquired a far greater weight per individual, which must not be confounded with the difference in weight which might have existed between the oldest and the youngest at the time of migration.

Among salmon this initial difference is very slight, with sea-trout it is slightly more pronounced, and in the case of Mjøsen trout a four-year-old migrant is on an average 24·7 cm., while a six-year-old is 30·2 cm. (see page 64), so that the difference is thus (cf. Table XXXVIII.) not more than about 100 grammes.

The ultimate difference in weight is therefore not due to the slightly greater or smaller size at migration. There must be some cause at work which provides the older and slightly larger migrant with a capacity for growth and for utilising its surroundings, surpassing the capacity possessed by the younger and rather smaller migrant, for the former not only maintains its slight start, but increases it very considerably.

However, these examples merely give us indications and hints that there are many reasons for a difference in the rate of growth, and these indications are chiefly noticeable because they show us that it will only be by working experimentally, and by separating and studying apart each of

	Average Weight in Hectos of Fish that at Migration or Change of Growth were Aged				
	2 winters.	3 winters.	4 winters	5 winters.	6 winters.
Salmon 2 winters after migration . .	37·1	40·8	44·8	—	—
Sea-trout 2 winters after migration . .	3·7	5·1	6·5	8·0	—
Mjøsen trout 3 winters after migration or change of growth	—	—	25·1	29·6	34·3

the different forms of influence which produce development, that we can hope to get a clearer understanding of these growth-problems.

It will no doubt be extremely interesting from a scientific point of view to be able to go more fully into these problems, but what I consider most important at present is that every additional contribution to our knowledge of the causes of growth will have an important practical effect upon all questions of pisciculture, that is to say questions relating to rational utilisation of a given stock of a given water.

So long as we remain in doubt regarding the reasons for difference in growth, we shall also continue uncertain how to obtain the utmost benefit from vigorous growth, or how to improve poor growth, or again, how to gain control over development in such a way as to make these animals subject to us, that is to say, by finding out the forms most suitable for pisciculture.

Questions like these can now be solved by systematic experiment, and the results we have obtained will, I think, render such experiments far more successful than they might otherwise have been.

Merely to mention one form of pisciculture which is of the utmost importance over here, namely, the better utilisation of all the possibilities of our fresh water lakes, the knowledge we have acquired should be of great assistance.

Hitherto the greatest obstacle has been that it was impossible to control the stock.

The methods, however, whose results we have here discussed, should cause this difficulty to disappear.

We can now examine age and growth, and thus obtain the means of estimating what results are derived from the different measures adopted, such as turning out young fish, preserving the waters, and regulating the fishery. We can also keep a better check on our experiments by tracing the age and growth of the fish in general, as well as also each individual's growth-history.

Just as the forester estimates his forests by borings and calculations of growth, so, too, we should be able to estimate the stock of fish in the water, and endeavour to set up a plan of operations based on assessments of age and growth. No doubt it has not yet been proved that this is possible, but our endeavours should be made in this direction.

Bound up with the problem of rational utilisation of our waters is the question of recruiting the stock.

Some of my results have led me to believe that it may be an advantage in many waters to turn out fairly large fish in place of small fry.

This question arises in all waters where the fish in their young stages have a poor development, followed subsequently by splendid growth.

Lake Mjøsen may be taken as an instance of this. If we look at the table on page 76 we find that the trout which began their vigorous growth at the age of six winters, grew far better than those which commenced at an earlier age, so much so, indeed, that we should almost gain one kilo. by employing the oldest fish. The difference in weight which we finally get is far greater than the slight difference existing between the weights of the fish when they first commenced their vigorous growth in Mjøsen.

It might be worth trying whether it would pay to turn out such trout at the most favourable age, and we could mark them and watch the results.

Another example is also worth mentioning. At Trondenes Manse there is a little shut-in tarn called Laugen, where there used to be no fish, but which swarmed with water-fleas (Gammarus). Some trout-fry were turned into it, and grew capitally, but they did not increase in number, and were gradually all captured.

Close by the manse there is a little burn, where there are quantities of the ordinary poorly-developed burn-trout. The priest's sons used to amuse themselves by catching these small trout, and turning hundreds of

them into the lake, and I have caught some of them and examined their scales. The results are quite remarkable. One of their scales is to be seen in Fig. 33 (Plate X.), which represents the scale of a trout 36 cm. long that weighed 650 grammes. The trout has first grown very poorly for three years, and has then spent a summer in Laugen, where it has developed enormously. After the usual winter stagnation, the fish has passed through another summer with again enormous growth.

Similar illustrations of growth were afforded by all the 21 fish from this lake that I examined, and the following table shows the averages I got by my investigations :—

Calculated Average Size before Transference.	Average Length and Weight when Caught.		
	1st summer in Laugen.	2nd summer in Laugen.	3rd summer in Laugen.
Length 14·4 cm. . .	27·9 cm.	35·4 cm.	45 cm.
Weight about 0.25 hg. .	2·7 hg.	6·6 hg.	11·0 hg.

This is a clear instance of what beneficial and valuable use has been made of these small slow-growing and relatively worthless fish, and it shows how well they have been made to grow by transferring them to Laugen.

It is also interesting to look at the weights they attained in their first and second summer, compared with the age and weight they had at the time of transference.

	Average Weight of Fish which when Transferred had Completed			
	2 winters.	3 winters.	4 winters.	5 winters.
At transference * . .	9 gr.	20 gr.	23 gr.	43 gr.
1 summer in Laugen . .	2 hg.	2·7 hg.	3·5 hg.	—
2 summers in Laugen .	4 hg.	6·2 hg.	7·2 hg.	7·8 hg.

This second table shows us quite clearly that it is apparently an advantage to turn out older fish, and it might be well worth while experimenting with the various possibilities suggested by these results.

I have given these instances because they seem to me to indicate some of the lines along which experiment and study of growth should go.

* Found by calculating the average lengths of the fish at time of transference (from measurements of the scales), and translating these lengths into average weights as per Table XXXVIII.

For other questions connected with development, other modes of investigation will have to be discovered, and in particular questions of race, and questions dealing with tendency to growth, or a hereditary capacity for growth, will naturally have to be studied in such a manner as to ensure complete control and isolation of every influence.

In conclusion I may add that there is no doubt that the methods of investigation which have been discussed in this work will be of general benefit in many directions in experimental and investigation work, inasmuch as they have enabled us to penetrate into the secrets connected with the growth and the life history of every trout and every salmon more deeply than has ever been done before.

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,,	XI.	Age and Weight in Hektograms of 1,612 Salmon from Christiansand, 1909.
,,	XII.	Age and Weight in Hektograms of 184 Salmon from Moltuen, 1909.
,,	XIII.	Age and Weight in Hektograms of 284 Salmon from Bugønes, Varanger, 1909.
,,	XIV.	Sex, Length, and Age of 48 Salmon from Fosen—Senjen, June 30—July 2, 1909.
,,	XV.	Sex and Length of Spawning Salmon from Laerdal and Drammen Rivers.
,,	XVI.	Sex and Length of Spawning Salmon from Aaen-sire River, years 1886—1897.

TROUT.*

,,	XVII.	Age, Length, and average Weight of 192 Sea-Trout from Trondhjem, June 26—29, 1909.
,,	XVIII.	Age, Sex, and Length of 59 Trout from Daløs River, Utskarpen, September 1—10, 1907.
,,	XIX.	Age, Sex, and Length of 82 Sea-Trout from Utskarpen, Ranen-fiord, September 1—10, 1907.
,,	XX.	Aggregate Age, Sex, and Length of 142 Trout and Sea-Trout from Utskarpen, September 1—10, 1907.
,,	XXI.	Age, Sex and Length of 43 Trout from Aag-vand, Rodö, Nordre Helgeland, August 12, 1908.

* The state of the sexual organs is, where examination has taken place, indicated partly by letters: m = mature, im = immature; it is also sometimes indicated by figures:
2 = small ova visible, milt somewhat swollen in front.
3 = roe and milt nearly half as long as ventral cavity.
4 and 5 = sexual organs nearly (4) or wholly (5) filling neutral cavity.
6 = spawning.
7 = spent.
Sexual organs with less development than 2 are signified by—

Table XXII. Age, Sex, and Length of 95 Trout from Kvern-vand, Nærø (Namdal), July 6, 1909.
,, XXIIB. Calculated Lengths at Formation of different Winter-Bands of the Fish in Table XXII.
,, XXIII. Age, Sex, and Length of trout from Mölnbugtelv, Agdenes (Trondhjem District), July 4, 1909.
,, XXIIIB. Calculated Lengths of Fish in Table XXIII. at Formation of the various Winter-Bands.
,, XXIV. Age, Sex, and Length of 55 Trout. Os River 1. Tysdalsvand, May 15—18, 1909.
,, XXV. Age, Sex, and Length of 155 Trout. Os River 2. Foot of Bergstøvand, May 19, 1909.
,, XXVI. Age, Sex, and Length of 132 Trout. Os River 3. Bergstøvand River Mouth at Sand. May 10, 1909.
,, XXVII. Age and Length of 171 Trout from River Laagen, Lillehammer.
,, XXVIIB. Age and Weight of Fish in Table XXVII.
,, XXVIIC. Calculated Lengths of Fish in Table XXVII. at Formation of different Winter-Bands.
,, XXVIII. Calculated Lengths at Formation of different Winter-Bands of Trout from River Laagen between Langesjøen and Hølen (Numedal, Hardanger-vidde), August 26, 27, 1909.
,, XXIX. Calculated Length at Formation of different Winter-Bands in 8 Trout from River Laagen below Hølen (Numedal, Hardanger-vidde), August 23, 1909.
,, XXX. Calculated Length at Formation of different Winter-Bands of 20 Trout from Lake Hølen (Numedal, Hardanger-vidde), August 27, 28, 1909.
,, XXXI. Calculated Length at Formation of different Winter-Bands of 9 Trout from River Djupe (Hardanger-vidde) August 24, 1909.
,, XXXII. Calculated Length at Formation of different Winter-Bands of 6 Trout from Lake Ossjøen, Dagalid, Numedal, September 7, 8, 1909.
,, XXXIII. Age, Sex, and Length of 79 Trout from Krokaa, Skilbotten, Brønnø, Helgeland, July 21, 1907.
,, XXXIIIB. Age, Sex, and Length of 31 Trout from Krokaa, Skilbotten, Brønnø, (Helgeland), August 8, 1907.
,, XXXIV. Age, Sex, and Length of 115 Trout from Lake Sannavand near Harstad (Nordland), August 3, 1909.
,, XXXIVB. Calculated Length at Formation of different Winter-Bands of the Fish in Table XXXIV.
,, XXXV. Age, Sex, and Length of 108 Trout from Chaigijok (Lakselv, Finmarken), July 15—20, 1909.
,, XXXVB. Calculated Length at Formation of different Winter-Bands of the Fish in Table XXXV.
,, XXXVI. Calculated Length at Formation of different Winter-Bands of 15 Trout from River Luostijok, July 17—September 4, 1909.
,, XXXVII. Calculated Length at Formation of different Winter-Bands of 10 Trout from Lake Gagavand, August 27—September 18, 1909.
,, XXXVIII. Average Weight of Trout in Relation to Length.

TABLE I.

Salmon Parr and Smolts from different Rivers in Norway.

Locality.	Length in cm.	Number of Fish Examined.	1 winter.					2 winters.					3 winters.					4 winters.					5 winters.				
			♂		♀		Tot.	♂		♀		Tot.	♂		♀		Tot.	♂		♀		Tot.	♂		♀		Tot.
			m.	um.	m.	um.		m.	um.	m.	um.		m.	um.	m.	um.		m.	um.	m.	um.		m.	um.	m.	um.	
Os-River pr. Bergen, September 20, 1908.	8	4	—	1	—	3	4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	9	7	—	2	—	5	7	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	10	20	1	5	—	8	14	—	2	—	4	6	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	11	10	—	—	—	1	1	1	4	—	4	9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	12	14	—	—	—	—	—	7	2	—	5	14	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	13	3	—	—	—	—	—	1	—	—	1	2	1	—	—	—	1	—	—	—	—	—	—	—	—	—	—
	14	1	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1	—	—	—	—	—	—	—	—	—	—
	Total	59	1	8	—	17	26	9	8	—	14	31	2	—	—	—	2	—	—	—	—	—	—	—	—	—	—
Orkla (Aarlivold), July 27—31, 1908.	7	1	—	—	—	1	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	8	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	9	4	—	2	—	1	3	—	—	—	1	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	10	11	—	—	—	1	1	—	3	—	7	10	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	11	37	—	—	—	—	—	1	20	—	14	35	—	1	—	1	2	—	—	—	—	—	—	—	—	—	—
	12	38	—	—	—	—	—	3	9	—	19	31	1	2	—	4	7	—	—	—	—	—	—	—	—	—	—
	13	11	—	—	—	—	—	—	2	—	3	5	4	1	—	1	6	—	—	—	—	—	—	—	—	—	—
	14	2	—	—	—	—	—	—	—	—	—	—	—	1	—	1	2	—	—	—	—	—	—	—	—	—	—
	Total	104	—	2	—	3	5	4	34	—	44	82	5	5	—	7	17	—	—	—	—	—	—	—	—	—	—
Lakse-elv, Finmarken, July 15—25, 1909.	9	3	—	—	—	—	—	—	2	—	1	3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	10	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	11	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	1	2	—	—	—	—	—
	12	12	—	—	—	—	—	—	—	—	—	—	1	—	—	1	2	4	—	—	6	10	—	—	—	—	—
	13	25	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	11	2	—	12	25	—	—	—	—	—
	14	12	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1	7	—	—	4	11	—	—	—	—	—
	15	13	—	—	—	—	—	—	—	—	—	—	—	1	—	—	1	6	—	—	6	12	—	—	—	—	—
	16	4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	3	—	—	—	3	1	—	—	—	1
	Total	71	—	—	—	—	—	—	2	—	1	3	2	1	—	1	4	32	2	—	29	63	1	—	—	—	1

m = mature, um = immature.

TABLE II.

Salmon. Sandeidfjord. Ryfylke, July 28—August 21. 1908

Winters after Migration.	0			
	Winters before Migration. Birth-year.			
Length in cm.	2	3	4	Total.
	1906.	1905.	1904.	
22	1	—	1	2
23	2	2	—	4
24	1	1	—	2
25	2	2	1	5
26	2	2	—	4
27	1	—	1	2
Total	9	7	3	19

TABLE III.

Salmon. Locality: Christiansand. Date: Season, 1908.

Winters after Migration.		1					2					3				4		
Length in cm.	Number of Fish Examined.	Winters before Migration. Birth-year.					Winters before Migration. Birth-year.					Winters before Migration. Birth-year.				Winters before Migration. Birth-year.		
		2	3	4	5	Tot.	2	3	4	5	Tot.	2	3	4	Tot.	2	3	Tot.
		1905	1904	1903	1902		1904	1903	1902	1901		1903	1902	1901		1902	1901	
43	1	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—
46	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
49	7	—	—	—	—	7	—	—	—	—	—	—	—	—	—	—	—	—
52	35	—	—	—	—	35	—	—	—	—	—	—	—	—	—	—	—	—
55	87	—	—	—	—	87	—	—	—	—	—	—	—	—	—	—	—	—
58	85	—	—	—	—	83	—	—	—	—	(2)	—	—	—	—	—	—	—
61	37	—	—	—	—	26	—	—	—	—	6 (5)	—	—	—	—	—	—	—
64	29	—	—	—	—	—	—	—	—	—	25 (3)	—	—	—	(1)	—	—	—
67	39	—	—	—	—	—	—	—	—	—	37 (1)	—	—	—	(1)	—	—	—
70	80	—	—	—	—	—	—	—	—	—	71 (4)	—	—	—	(5)	—	—	—
73	91	—	—	—	—	—	—	—	—	—	81	—	—	—	2 (8)	—	—	—
76	75	—	—	—	—	—	—	—	—	—	71 (1)	—	—	—	(3)	—	—	—
79	50	—	—	—	—	—	—	—	—	—	44 (1)	—	—	—	1 (4)	—	—	—
82	20	—	—	—	—	—	—	—	—	—	20	—	—	—	—	—	—	—
85	11	—	—	—	—	—	—	—	—	—	8	—	—	—	(3)	—	—	—
88	5	—	—	—	—	—	—	—	—	—	2	—	—	—	2	—	—	(1)
91	6	—	—	—	—	—	—	—	—	—	1	—	—	—	4	—	—	(1)
94	1	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—
97	3	—	—	—	—	—	—	—	—	—	—	—	—	—	2	—	—	(1)
100	4	—	—	—	—	—	—	—	—	—	—	—	—	—	4	—	—	—
103	3	—	—	—	—	—	—	—	—	—	—	—	—	—	3	—	—	—
106	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
109	1	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—
112	2	—	—	—	—	—	—	—	—	—	—	—	—	—	2	—	—	—
115	1	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—
118	2	—	—	—	—	—	—	—	—	—	—	—	—	—	2	—	—	—
121	1	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—
Tot.	676	118	101	16	1	239	95	265	16	1	366 (17)	9	40	2	26 (25)	1	2	(3)
Average length in cm.		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		—	—	—	—	—	—	—	—	—	73·2	—	—	—	98·7	—	—	—
		—	—	—	—	56·2	—	—	—	—	(64·9)	—	—	—	(74)	—	—	—

N.B.—Fish with spawning-mark in brackets.

TABLE IV.

Salmon. Locality: Moltuen. Date: Season, 1908.

Winters after Migration.		1									3				
Length in cm.	Number of Fish Examined.	Winters before Migration. Birth-year.				Winters before Migration. Birth-year.					Winters before Migration. Birth-year.				
		2	3	4	Tot.	2	3	4	5	Tot.	2	3	4	Tot.	Tot.
		1905	1904	1903		1904	1903	1902	1901		1903	1902	1901		
43	1	—	—	—	1	—	—	—	—	—	—	—	—	—	—
46	1	—	—	—	1	—	—	—	—	—	—	—	—	—	—
49	4	—	—	—	4	—	—	—	—	—	—	—	—	—	—
52	8	—	—	—	8	—	—	—	—	—	—	—	—	—	—
55	7	—	—	—	7	—	—	—	—	—	—	—	—	—	—
58	6	—	—	—	5	—	—	—	—	(1)	—	—	—	—	—
61	4	—	—	—	1	—	—	—	—	3	—	—	—	—	—
64	9	—	—	—	1	—	—	—	—	7 (1)	—	—	—	—	—
67	7	—	—	—	—	—	—	—	—	6 (1)	—	—	—	—	—
70	21	—	—	—	—	—	—	—	—	20	—	—	—	(1)	—
73	32	—	—	—	—	—	—	—	—	31	—	—	—	1	—
76	33	—	—	—	—	—	—	—	—	32	—	—	—	(1)	—
79	30	—	—	—	—	—	—	—	—	28	—	—	—	1 (1)	—
82	19	—	—	—	—	—	—	—	—	15	—	—	—	1 (3)	—
85	18	—	—	—	—	—	—	—	—	14	—	—	—	4	—
88	8	—	—	—	—	—	—	—	—	6	—	—	—	2	—
91	7	—	—	—	—	—	—	—	—	2	—	—	—	5	—
94	14	—	—	—	—	—	—	—	—	1	—	—	—	13	—
97	11	—	—	—	—	—	—	—	—	1	—	—	—	10	—
100	5	—	—	—	—	—	—	—	—	—	—	—	—	5	—
103	6	—	—	—	—	—	—	—	—	—	—	—	—	5 (1)	—
106	4	—	—	—	—	—	—	—	—	—	—	—	—	4	—
109	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
112	4	—	—	—	—	—	—	—	—	—	—	—	—	4	—
115	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
118	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
121	1	—	—	—	—	—	—	—	—	—	—	—	—	1	—
124	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
127	1	—	—	—	—	—	—	—	—	—	—	—	—	—	1
Tot.	261	9	18	1	28	15	120	26	3	166 (3)	8	42	9	56 (7)	1
Average length in cm.		—	—	—	54·9	—	—	—	—	76·2 (60·5)	—	—	—	95·6 (82·0)	—

N.B.—Fish with spawning-mark in brackets.

TABLE V.

Salmon. Locality: Orkla. Date: Season, 1908.

Winters after Migration.		1					2					3				4	
Length in cm.	Number of Fish Examined.	Winters before Migration. Birth-year.					Winters before Migration. Birth-year.					Winters before Migration. Birth-year.				Winters before Migration. Birth-year	
		2	3	4	5	Tot.	2	3	4	5	Tot.	2	3	4	Tot.	2	Tot.
		1905	1904	1903	1902		1904	1903	1902	1901		1903	1902	1901		1902	
43	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
46	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
49	1	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—
52	4	—	—	—	—	4	—	—	—	—	—	—	—	—	—	—	—
55	6	—	—	—	—	6	—	—	—	—	—	—	—	—	—	—	—
58	4	—	—	—	—	4	—	—	—	—	—	—	—	—	—	—	—
61	4	—	—	—	—	4	—	—	—	—	—	—	—	—	—	—	—
64	4	—	—	—	—	—	—	—	—	—	4	—	—	—	—	—	—
67	2	—	—	—	—	—	—	—	—	—	2	—	—	—	—	—	—
70	6	—	—	—	—	—	—	—	—	—	6	—	—	—	—	—	—
73	16	—	—	—	—	—	—	—	—	—	16	—	—	—	—	—	—
76	29	—	—	—	—	—	—	—	—	—	29	—	—	—	—	—	—
79	20	—	—	—	—	—	—	—	—	—	19	—	—	—	1	—	—
82	14	—	—	—	—	—	—	—	—	—	12	—	—	—	2	—	—
85	30	—	—	—	—	—	—	—	—	—	25	—	—	—	4 (1)	—	—
88	20	—	—	—	—	—	—	—	—	—	18	—	—	—	2	—	—
91	18	—	—	—	—	—	—	—	—	—	11	—	—	—	6 (1)	—	—
94	18	—	—	—	—	—	—	—	—	—	8	—	—	—	10	—	—
97	21	—	—	—	—	—	—	—	—	—	1	—	—	—	19	(1)	(1)
100	12	—	—	—	—	—	—	—	—	—	—	—	—	—	12	—	—
103	7	—	—	—	—	—	—	—	—	—	—	—	—	—	7	—	—
106	3	—	—	—	—	—	—	—	—	—	—	—	—	—	3	—	—
109	2	—	—	—	—	—	—	—	—	—	—	—	—	—	2	—	—
112	2	—	—	—	—	—	—	—	—	—	—	—	—	—	2	—	—
115	1	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—
118	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Tot.	244	2	16	1	—	19	17	109	26	2	151	14	54	5	71 (2)	1	(1)
Average length in cm.		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		—	—	—	—	56	—	—	—	—	81	—	—	—	96·9	—	—
		—	—	—	—	—	—	—	—	—	—	—	—	—	(88)	—	—

N.B.—Fish with spawning-mark in brackets.

TABLE VI.

Salmon. **Locality: East Finmarken.** **Date: July, 1908.**

Winters after Migration.		1.			2.					3.					4.	
Length in cm.	Number of Fish Examined.	Winters before Migration. Birth-year.			Winters before Migration. Birth-year.					Winters before Migration. Birth-year.					Winters before Migration. Birth-year.	
		3	4	Tot.	2	3	4	5	Tot.	2	3	4	5	Tot.	4	Tot.
		1904	1903		1904	1903	1902	1901		1903	1902	1901	1900		1900	
43	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
46	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
49	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
52	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
55	5	—	—	5	—	—	—	—	—	—	—	—	—	—	—	—
58	6	—	—	6	—	—	—	—	—	—	—	—	—	—	—	—
61	5	—	—	4	—	—	—	—	1	—	—	—	—	—	—	—
64	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
67	3	—	—	1	—	—	—	—	2	—	—	—	—	—	—	—
70	3	—	—	—	—	—	—	—	3	—	—	—	—	—	—	—
73	1	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—
76	2	—	—	—	—	—	—	—	2	—	—	—	—	—	—	—
79	5	—	—	—	—	—	—	—	4	—	—	—	—	(1)	—	—
82	5	—	—	—	—	—	—	—	5	—	—	—	—	—	—	—
85	8	—	—	—	—	—	—	—	3	—	—	—	—	5	—	—
88	8	—	—	—	—	—	—	—	—	—	—	—	—	8	—	—
91	9	—	—	—	—	—	—	—	—	—	—	—	—	8	—	(1)
94	13	—	—	—	—	—	—	—	—	—	—	—	—	13	—	—
97	3	—	—	—	—	—	—	—	—	—	—	—	—	3	—	—
100	6	—	—	—	—	—	—	—	—	—	—	—	—	5	—	1
103	3	—	—	—	—	—	—	—	—	—	—	—	—	3	—	—
106	3	—	—	—	—	—	—	—	—	—	—	—	—	3	—	—
109	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
112	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
118	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
Tot.	89	9	7	16	2	10	6	3	21	5	33	9	1	48 (1)	2	2 (1)
Average length in cm.		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		—	—	—	—	—	—	—	—	—	—	—	—	93·3	—	—
		—	—	58·5	—	—	—	—	75·9	—	—	—	—	(79)	—	—

N.B.—Fish with spawning-mark in brackets.

TABLE VII.

AVERAGE WEIGHT OF SALMON OF DIFFERENT AGES IN GRAMMES, 1908.

Locality.	Age after Migration.						
	1 winter.	2 winters.		3 winters.		4 winters.	
	Without spawning mark.	Without spawning mark.	With spawning mark.	Without spawning mark.	With spawning mark.	Without spawning mark.	With spawning mark.
Christiansand .	1,675	3,972	2,735	11,162	4,108	—	7,778
Moltuen . .	1,793	5,091	2,550	10,593	6,750	21,500	—
Orkla . . .	1,816	5,895	—	10,503	8,350	—	10,300
East Finmarken .	2,047	4,909	—	9,629	5,300	13,250	8,600

TABLE VIII.

Salmon. Locality: Christiansand. Date: Season 1909.

Winter after Migration.		1					2					3				4				6	
Length in cm.	Number of Individuals Examined.	Winters before Migration. Birth-year.					Winters before Migration. Birth-year.					Winters before Migration. Birth-year.				Winters before Migration. Birth-year.				Winters before Migration. Birth-year	
		2	3	4	5	Tot.	2	3	4	5	Tot.	2	3	4	Tot.	3	4	5	Tot.	3	Tot.
		1906	1905	1904	1903		1905	1904	1903	1902		1904	1903	1902		1902	1901	1900		1900	
43	2	—	2	—	—	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
46	9	2	6	1	—	9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
49	31	11	19	1	—	31	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
52	167	40	114	12	1	167	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
55	227	36	163	20	1	220	—	1 (6)	—	—	1 (6)	—	—	—	—	—	—	—	—	—	—
58	156	7	105	27	5	144	(2)	6 (2)	1 (1)	—	7 (5)	—	—	—	—	—	—	—	—	—	—
61	72	2	27	12	—	41	3 (4)	12 (6)	2 (1)	—	17 (11)	—	(2)	(1)	(3)	—	—	—	—	—	—
64	59	—	1	1	—	2	14 (3)	28 (5)	5	1	48 (8)	—	—	(1)	(1)	—	—	—	—	—	—
67	115	—	—	2	—	2	40	59 (3)	10	—	109 (3)	—	(1)	—	(1)	—	—	—	—	—	—
70	152	—	—	—	—	—	39	93	12	1	145	—	(6)	(1)	(7)	—	—	—	—	—	—
73	207	—	—	—	—	—	39	132 (1)	20	1	192 (1)	1 (2)	(9)	(1)	1 (12)	(1)	—	—	(1)	—	—
76	169	—	—	—	—	—	24	114	18	—	156	1	2 (8)	(2)	3 (10)	—	—	—	—	—	—
79	122	—	—	—	—	—	13	72	28	1	114	1	2 (3)	1 (1)	4 (4)	—	—	—	—	—	—
82	50	—	—	—	—	—	3	31	5	—	39	1	4 (5)	(1)	5 (6)	—	—	—	—	—	—
85	30	—	—	—	—	—	—	14	4	—	18	1	6 (3)	(2)	7 (5)	—	—	—	—	—	—
88	10	—	—	—	—	—	—	3	3	—	6	2	1	1	4	—	—	—	—	—	—
91	8	—	—	—	—	—	1	1	1	—	3	—	3	2	5	—	—	—	—	—	—
94	7	—	—	—	—	—	—	—	—	—	—	1	4	1	6	—	—	(1)	(1)	—	—
97	6	—	—	—	—	—	—	—	—	—	—	1	2	1	4	(1)	(1)	—	(2)	—	—
100	2	—	—	—	—	—	—	—	—	—	—	1	—	1	2	—	—	—	—	—	—
103	2	—	—	—	—	—	—	—	—	—	—	1	1	—	2	—	—	—	—	—	—
106	4	—	—	—	—	—	—	—	—	—	—	—	4	—	4	—	—	—	—	—	—
109	3	—	—	—	—	—	—	—	—	—	—	—	—	2	2	—	—	—	—	(1)	(1)
112	2	—	—	—	—	—	—	—	—	—	—	—	2	—	2	—	—	—	—	—	—
115	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Tot.	1,612	98	437	76	7	618	176 (9)	566 (23)	109 (2)	4	855 (34)	11 (2)	31 (37)	9 (10)	51 (49)	(2)	(1)	(1)	(4)	(1)	(1)
Average length in cm.		53·3 —	54·9 —	56·7 —	56·3 —	54·9 —	71·2 (61·2)	73·2 (61·3)	75 (60)	71·8 —	73 (61·2)	87·8 (73·5)	91·4 (75·1)	94·8 (75·2)	91·3 (75·1)	— —	— —	— —	— —	— —	— —

NB.—Fish with spawning mark in brackets.

TABLE IX.

Salmon. Locality: Moltuen. Date: Season 1909.

Winters after Migration.		1					2				3				4		5	
Length in cm.	Number of Fish Examined.	Winters before Migration. Birth-year.					Winters before Migration. Birth-year.				Winters before Migration. Birth-year.				Winters before Migration. Birth-year.		Winters before Migration. Birth-year.	
		2	3	4	5	Tot.	2	3	4	Tot.	2	3	4	Tot.	3	Tot.	3	Tot.
		1906	1905	1904	1903		1905	1904	1903		1904	1903	1902		1902		1901	
43	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
46	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
49	3	—	3	—	—	3	—	—	—	—	—	—	—	—	—	—	—	—
52	9	—	7	2	—	9	—	—	—	—	—	—	—	—	—	—	—	—
55	11	—	9	1	1	11	—	—	—	—	—	—	—	—	—	—	—	—
58	15	3	6	6	—	15	—	—	—	—	—	—	—	—	—	—	—	—
61	4	1	2	1	—	4	—	—	—	—	—	—	—	—	—	—	—	—
64	2	—	—	1	—	1	—	1	—	1	—	—	—	—	—	—	—	—
67	7	1	—	—	—	1	1	3	2	6	—	—	—	—	—	—	—	—
70	14	—	—	—	—	—	3	10	1	14	—	—	—	—	—	—	—	—
73	13	—	—	—	—	—	1	9	3	13	—	—	—	—	—	—	—	—
76	17	—	—	—	—	—	—	13	4	17	—	—	—	—	—	—	—	—
79	8	—	—	—	—	—	—	6	2	8	—	—	—	—	—	—	—	—
82	10	—	—	—	—	—	—	6	2	8	—	1	(1)	1 (1)	—	—	—	—
85	5	—	—	—	—	—	—	2	1	3	—	2	—	2	—	—	—	—
88	10	—	—	—	—	—	—	2	2	4	—	4	2	6	—	—	—	—
91	15	—	—	—	—	—	—	—	1	1	—	10 (2)	2	12 (2)	—	—	—	—
94	11	—	—	—	—	—	—	—	—	—	—	6 (1)	4	10 (1)	—	—	—	—
97	14	—	—	—	—	—	—	—	—	—	1	5	4	10	(4)	(4)	—	—
100	6	—	—	—	—	—	—	—	—	—	—	3	2	5	(1)	(1)	—	—
103	4	—	—	—	—	—	—	—	—	—	—	2	2	4	—	—	—	—
106	3	—	—	—	—	—	—	—	—	—	—	1	1	2	—	—	(1)	(1)
109	2	—	—	—	—	—	—	—	—	—	—	1	—	1	—	—	(1)	(1)
112	1	—	—	—	—	—	—	—	—	—	—	—	1	1	—	—	—	—
115	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Tot.	184	5	27	11	1	44	5	52	18	75	1	35 (3)	18 (1)	54 (4)	(5)	(5)	(2)	(2)
Average length in cm.		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		—	—	—	—	—	—	—	—	—	—	93·9	—	94·9	—	—	—	—
		60·8	54·7	58	—	56·1	69·8	75·6	77·5	75·4	96	(91·3)	97·2	(88·8)	—	—	—	—

NB.—Fish with spawning mark in brackets.

TABLE X.

Salmon. Locality: Bugønes, Syd-Varanger.
Date: Season 1909, up to the beginning of July.

Winters after Migration.		2					3					4						
Length in cm.	Number of Fish Examined.	Winters before Migration. Birth-year.					Winters before Migration. Birth-year.					Winters before Migration. Birth-year.				Winters before Migration. Birth-year.		
		2	3	4	5	Tot.	2	3	4	5	Tot.	3	4	5	Tot.	3	4	Tot.
		1905	1904	1903	1902		1904	1903	1902	1901		1902	1901	1900		1901	1900	
43	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
46	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
49	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
52	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
55	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
58	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
61	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
64	3	—	2	1	—	3	—	—	—	—	—	—	—	—	—	—	—	—
67	6	1	1	2	—	4	—	—	(2)	—	(2)	—	—	—	—	—	—	—
70	3	—	1	2	—	3	—	—	—	—	—	—	—	—	—	—	—	—
73	8	—	1	1	—	2	—	2 (1)	1	—	3 (1)	(1)	(1)	—	(2)	—	—	—
76	10	—	2	1	1	4	1	2 (1)	1	—	4 (1)	—	(1)	—	(1)	—	—	—
79	16	—	3	1	—	4	—	5 (1)	4	—	9 (1)	—	(2)	—	(2)	—	—	—
82	23	—	1	1	1	3	1	7 (1)	9	1	18 (1)	(1)	—	—	(1)	—	—	—
85	39	—	—	—	1	1	—	21	10	4	35	(1)	(2)	—	(3)	—	—	—
88	56	—	—	—	—	—	—	21	28 (1)	4	53 (1)	(2)	—	—	(2)	—	—	—
91	47	—	—	—	—	—	2	26	15	2	45	(1)	(1)	—	(2)	—	—	—
94	34	—	—	—	—	—	2	11	17	2	32	(1)	(1)	—	(2)	—	—	—
97	22	—	—	—	—	—	—	8	10	1	19	(1)	(1)	—	(2)	—	(1)	(1)
100	7	—	—	—	—	—	—	4	1	—	5	—	(1)	—	(1)	—	(1)	(1)
103	4	—	—	—	—	—	—	1	1	1	3	—	—	1	1	—	—	—
106	3	—	—	—	—	—	—	—	1	—	1	—	—	—	—	(2)	—	(2)
109	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(1)	(1)
112	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
115	2	—	—	—	—	—	—	—	—	—	—	—	1	1	2	—	—	—
Tot.	284	1	11	9	3	24	6	108 (4)	98 (3)	15	227 (7)	(81)	1 (10)	2	3 (18)	(2)	(3)	(5)
Average length in cm.		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		—	—	—	—	—	—	—	—	—	89·1	—	—	—	110·7	—	—	—
		—	—	—	—	73·9	87·8	88·7	89·5	89·5	(76)	—	—	—	(86·7)	—	—	(103·8)

N.B.—Fish with spawning mark in brackets.

TABLE XI.

Salmon. Locality: Christiansand. Date: Season 1909.

Winters after Migration.		1					2					3				4				6	
Weight in hektograms.	Number of Fish Examined.	Winters before Migration. Birth-year.					Winters before Migration. Birth-year.					Winters before Migration. Birth-year.				Winters before Migration. Birth-year.				Winters before Migration. Birth-year	
		2	3	4	5	Tot.	2	3	4	5	Tot.	2	3	4	Tot.	3	4	5	Tot.	3	Tot.
		1906	1905	1904	1903		1905	1904	1903	1902		1904	1903	1902		1902	1901	1900		1900	
7	3	1	2	—	—	3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
14	368	81	251	29	3	364	—	1 (3)	—	—	1 (3)	—	—	—	—	—	—	—	—	—	—
21	291	15	175	42	4	236	10 (4)	20 (11)	5 (2)	—	35 (17)	—	(1)	(2)	(3)	—	—	—	—	—	—
28	160	1	9	4	—	14	39 (5)	77 (8)	13	2	131 (13)	—	(2)	—	(2)	—	—	—	—	—	—
35	256	—	—	1	—	1	60	158 (1)	19	1	238 (1)	(1)	(13)	(2)	(16)	—	—	—	—	—	—
42	220	—	—	—	—	—	40	144	24	—	208	1 (1)	(9)	—	1 (10)	(1)	—	—	(1)	—	—
49	138	—	—	—	—	—	18	89	19	—	126	—	2 (7)	(3)	2 (10)	—	—	—	—	—	—
56	79	—	—	—	—	—	6	46	16	1	69	1	6 (1)	1 (1)	8 (2)	—	—	—	—	—	—
63	47	—	—	—	—	—	2	25	8	—	35	2	5 (3)	(2)	7 (5)	—	—	—	—	—	—
70	11	—	—	—	—	—	—	4	3	—	7	2	1 (1)	—	3 (1)	—	—	—	—	—	—
77	4	—	—	—	—	—	—	—	1	—	1	—	2	1	3	—	—	—	—	—	—
84	10	—	—	—	—	—	1	—	1	—	2	1	4	3	8	—	—	—	—	—	—
91	2	—	—	—	—	—	—	2	—	—	2	—	—	—	—	—	—	—	—	—	—
98	4	—	—	—	—	—	—	—	—	—	—	1	1	1	3	—	—	(1)	(1)	—	—
105	2	—	—	—	—	—	—	—	—	—	—	1	1	—	2	—	—	—	—	—	—
112	3	—	—	—	—	—	—	—	—	—	—	—	2	—	2	(1)	—	—	(1)	—	—
119	3	—	—	—	—	—	—	—	—	—	—	1	—	1	2	—	(1)	—	(1)	—	—
126	3	—	—	—	—	—	—	—	—	—	—	1	1	1	3	—	—	—	—	—	—
133	1	—	—	—	—	—	—	—	—	—	—	—	1	—	1	—	—	—	—	—	—
140	2	—	—	—	—	—	—	—	—	—	—	—	2	—	2	—	—	—	—	—	—
147	2	—	—	—	—	—	—	—	—	—	—	—	2	—	2	—	—	—	—	—	—
154	2	—	—	—	—	—	—	—	—	—	—	—	—	1	1	—	—	—	—	(1)	(1)
161	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
168	1	—	—	—	—	—	—	—	—	—	—	—	1	—	1	—	—	—	—	—	—
Tot.	1,612	98	437	76	7	618	176 (9)	566 (23)	109 (2)	4	855 (34)	11 (2)	31 (37)	9 (10)	51 (49)	(2)	(1)	(1)	(4)	(1)	(1)
Average weight in hgr.		15·6	17·1	19·1	17·9	17·1	37·1 (24·3)	40·8 (22·7)	44·2 (19)	38 —	41 (22·9)	81·5 (40)	87·9 (42·6)	98·4 (43·6)	88·4 (42·7)	—	—	—	—	—	—

N.B.—Fish with spawning mark in brackets.

TABLE XII.

Salmon. Locality: Moltuen. Date: Season 1909.

Winters after Migration.		1					2				3				4		5	
Weight in Hektograms.	Number of Fish Examined.	Winters before Migration. Birth-year.					Winters before Migration. Birth-year.				Winters before Migration. Birth-year.				Winters before Migration. Birth-year.		Winters before Migration. Birth-year.	
		2	3	4	5	Tot.	2	3	4	Tot.	2	3	4	Tot.	3	Tot.	3	Tot.
		1906	1905	1904	1903		1905	1904	1903		1904	1903	1902		1902		1901	
7	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
14	13	—	11	2	—	13	—	—	—	—	—	—	—	—	—	—	—	—
21	27	3	15	8	1	27	—	—	—	—	—	—	—	—	—	—	—	—
28	4	1	1	1	—	3	—	1	—	1	—	—	—	—	—	—	—	—
35	15	1	—	—	—	1	2	10	2	14	—	—	—	—	—	—	—	—
42	18	—	—	—	—	—	2	9	7	18	—	—	—	—	—	—	—	—
49	14	—	—	—	—	—	—	13	1	14	—	—	—	—	—	—	—	—
56	16	—	—	—	—	—	1	12	2	15	—	—	(1)	(1)	—	—	—	—
63	9	—	—	—	—	—	—	4	3	7	—	2	—	2	—	—	—	—
70	3	—	—	—	—	—	—	—	2	2	—	1	—	1	—	—	—	—
77	9	—	—	—	—	—	—	2	—	2	—	4 (1)	2	6 (1)	—	—	—	—
84	10	—	—	—	—	—	—	—	1	1	—	6 (1)	2	8 (1)	—	—	—	—
91	8	—	—	—	—	—	—	1	—	1	—	4	3	7	—	—	—	—
98	8	—	—	—	—	—	—	—	—	—	—	6 (1)	1	7 (1)	—	—	—	—
105	9	—	—	—	—	—	—	—	—	—	—	4	2	6	(3)	(3)	—	—
112	6	—	—	—	—	—	—	—	—	—	—	3	2	5	(1)	(1)	—	—
119	4	—	—	—	—	—	—	—	—	—	1	1	1	3	(1)	(1)	—	—
126	5	—	—	—	—	—	—	—	—	—	—	2	2	4	—	—	(1)	(1)
133	2	—	—	—	—	—	—	—	—	—	—	1	1	2	—	—	—	—
140	1	—	—	—	—	—	—	—	—	—	—	—	1	1	—	—	—	—
147	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(1)	(1)
154	1	—	—	—	—	—	—	—	—	—	—	—	1	1	—	—	—	—
161	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
168	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
175	1	—	—	—	—	—	—	—	—	—	—	1	—	1	—	—	—	—
182	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Tot.	184	5	27	11	1	44	5	52	18	75	1	35 (3)	18 (1)	54 (4)	(5)	(5)	(2)	(2)
Average weight in hgr.		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		26	18·2	20·7	19·5	19·5	40.6	48·9	52·3	49·1	—	97·3 (86·7)	111·2 (54)	100·8 (78·5)	—	—	—	—

N.B.—Fish with spawning mark in brackets.

TABLE XIII.

Salmon. Locality: Bugønes, Syd-Varanger.
Date: Season 1909 until the beginning of July.

Winters after Migration.		2					3					4				5		
Weight in hgr.	Number of Fish Examined.	Winters before Migration. Birth-year.					Winters before Migration. Birth-year.					Winters before Migration. Birth-year.				Winters before Migration. Birth-year.		
		2	3	4	5	Tot.	2	3	4	5	Tot.	3	4	5	Tot.	3	4	Tot.
		1905	1904	1903	1902		1904	1903	1902	1901		1902	1901	1900		1901	1900	
7	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
14	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
21	1	—	—	1	—	1	—	—	—	—	—	—	—	—	—	—	—	—
28	6	—	2	2	—	4	—	1	(1)	—	1 (1)	—	—	—	—	—	—	—
35	8	1	3	2	—	6	—	(1)	(1)	—	(2)	—	—	—	—	—	—	—
42	10	—	—	2	1	3	1	2	1	—	4	(1)	(2)	—	(3)	—	—	—
49	14	—	3	—	—	3	—	3 (2)	4	—	7 (2)	—	(2)	—	(2)	—	—	—
56	14	—	1	1	—	2	1	6 (1)	4	—	11 (1)	—	—	—	—	—	—	—
63	34	—	1	—	2	3	—	14	11	2	27	(2)	(2)	—	(4)	—	—	—
70	36	—	1	1	—	2	—	15	14	3	32	(1)	(1)	—	(2)	—	—	—
77	39	—	—	—	—	—	—	14	20 (1)	3	37 (1)	(1)	—	—	(1)	—	—	—
84	45	—	—	—	—	—	2	23	14	3	42	(2)	(1)	—	(3)	—	—	—
91	17	—	—	—	—	—	2	8	7	—	17	—	—	—	—	—	—	—
98	29	—	—	—	—	—	—	11	13	3	27	—	(1)	1	1 (1)	—	—	—
105	15	—	—	—	—	—	—	6	7	—	13	—	(1)	—	(1)	—	(1)	(1)
112	5	—	—	—	—	—	—	3	—	—	3	(1)	—	—	(1)	—	(1)	(1)
119	1	—	—	—	—	—	—	1	—	—	1	—	—	—	—	—	—	—
126	2	—	—	—	—	—	—	1	1	—	2	—	—	—	—	—	—	—
133	3	—	—	—	—	—	—	—	1	—	1	—	—	—	—	(1)	(1)	(2)
140	2	—	—	—	—	—	—	—	1	1	2	—	—	—	—	—	—	—
147	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(1)	—	(1)
154	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
161	1	—	—	—	—	—	—	—	—	—	—	—	1	—	1	—	—	—
168	1	—	—	—	—	—	—	—	—	—	—	—	—	1	1	—	—	—
175	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Tot.	284	1	11	9	3	24	6	108 (4)	98 (3)	15	227 (7)	8	1 (10)	2	3 (18)	(2)	(3)	(5)
Average weight in hgr.		—	—	—	—	44·2	75·7	79·3	79·7	83·1	79·9	—	—	—	142·7	—	—	—
		—	—	—	—	—	—	—	—	—	(46·7)	—	—	—	(70·0)	—	—	—
		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(126)

N.B.—Fish with spawning marks in brackets.

TABLE XIV.

Salmon. Fosen—Senjen. June 30—July 2, 1909.

Winters after Migration.		1			2		
Length in cm.	Number of Fish Examined.	♂	♀	Total.	♂	♀	Total.
49	2	2	—	2	—	—	—
50	3	3	—	3	—	—	—
51	2	2	—	2	—	—	—
52	8	8	—	8	—	—	—
53	9	9	—	9	—	—	—
54	10	10	—	10	—	—	—
55	5	5	—	5	—	—	—
56	1	1	—	1	—	—	—
57	2	2	—	2	—	—	—
58	1	1	—	1	—	—	—
59	—	—	—	—	—	—	—
60	1	—	—	—	—	1	1
61	1	—	—	—	—	1	1
62	1	—	—	—	—	1	1
63	1	—	—	—	—	1	1
64	—	—	—	—	—	—	—
65	—	—	—	—	—	—	—
66	—	—	—	—	—	—	—
67	—	—	—	—	—	—	—
68	—	—	—	—	—	—	—
69	1	—	—	—	—	1	1
Total	48	43	—	43	—	5	5

TABLE XV.

Size of Salmon (Spawning Fish). Lærdal and Drammen Rivers.

Length in cm.	Lærdal. 1892—99.			Drammen. 1895—99.		
	♂	♀	Total.	♂	♀	Total.
43	—	—	—	—	—	—
46	—	—	—	—	—	—
49	3	1	4	1	1	2
52	4	—	4	3	—	3
55	7	—	7	4	—	4
58	14	1	15	5	—	5
61	18	2	20	8	2	10
64	21	3	24	7	—	7
67	17	—	17	4	—	4
70	17	3	20	6	1	7
73	4	5	9	4	—	4
76	—	12	12	—	1	1
79	5	25	30	2	3	5
82	1	26	27	1	7	8
85	6	29	35	3	12	15
88	10	12	22	3	18	21
91	10	13	23	10	9	19
94	10	12	22	3	6	9
97	6	9	15	5	20	25
100	9	11	20	3	34	37
103	4	6	10	6	20	26
106	2	1	3	5	16	21
109	1	1	2	5	4	9
112	—	—	—	2	1	3
115	1	1	2	11	1	12
118	—	—	—	9	—	9
121	—	—	—	—	—	—
124	—	—	—	1	—	1
127	—		—	1	—	1
130	—	—	—	—	—	—
133	—	—	—	—	—	—
136	—	—	—	—	—	—
Total	169	173	342	112	155	267

TABLE XVI.

Size of Salmon (Spawning Fish). Aaen-sire River. Years 1886—1897.

Length in cm.	Number of Salmon Measured.																																	Total for all Years.					
	1886			1887			1888			1889			1890			1891			1892			1893			1894			1895			1896			1897					
	♂	♀	Tot.	♂	♀	Tot.	♂	♀	Tot.	♂	♀	Tot.	♂	♀	Tot.	♂	♀	Tot.	♂	♀	Tot.	♂	♀	Tot.	♂	♀	Tot.	♂	♀	Tot.	♂	♀	Tot.	♂	♀	Tot.	♂	♀	Total.
43	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	1	—	—	—	1	—	1
46	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	—	2	1	—	1	—	—	—	—	—	—	1	1	2	1	—	1	—	—	—	5	1	6
49	1	—	1	2	—	2	1	1	2	1	2	3	—	—	—	6	2	8	2	—	2	7	2	9	5	—	5	5	2	7	2	5	7	6	—	6	38	14	52
52	5	1	6	1	2	3	—	—	—	—	5	5	—	1	1	9	1	10	2	—	2	14	1	15	7	2	9	7	7	14	12	3	15	6	2	8	63	25	88
55	6	2	8	13	1	14	5	2	7	5	7	12	4	1	5	31	3	34	15	—	15	19	1	20	12	3	15	13	7	20	29	9	38	11	1	12	163	37	200
58	14	4	18	13	7	20	8	3	11	3	4	7	7	—	7	30	6	36	16	1	17	18	—	18	12	2	14	23	7	30	23	5	28	9	—	9	176	39	215
61	29	3	32	14	1	15	11	1	12	8	4	12	19	8	27	25	7	32	18	1	19	8	—	8	15	7	22	19	6	25	28	—	28	15	1	16	209	38	247
64	16	1	17	9	1	10	11	1	12	5	5	10	14	—	14	34	6	40	6	—	6	10	2	12	7	4	11	22	3	25	20	—	20	11	1	12	165	24	189
67	6	3	9	8	—	8	10	1	11	2	1	3	3	1	4	15	1	16	3	—	3	4	3	7	7	4	11	18	2	20	4	2	6	6	1	7	86	19	105
70	4	—	4	3	1	4	2	3	5	2	2	4	3	—	3	12	2	14	2	2	4	3	10	13	2	5	7	12	1	13	2	5	7	2	10	12	49	41	90
73	2	3	5	4	6	10	1	6	7	—	1	1	—	1	1	2	6	8	1	10	11	1	23	24	2	11	13	5	4	9	1	14	15	3	19	22	22	104	126
76	—	20	20	3	13	16	2	11	13	—	5	5	—	2	2	2	25	27	2	34	36	1	61	62	6	20	26	4	8	12	4	27	31	—	68	68	24	294	318
79	2	40	42	3	17	20	7	19	26	—	12	12	—	1	1	3	56	59	2	60	62	4	34	38	10	29	39	1	10	11	5	22	27	—	84	84	37	394	431
82	1	33	34	5	20	25	5	18	23	—	12	12	—	10	10	1	45	46	8	33	41	15	37	52	7	17	24	2	14	16	3	13	16	—	60	60	47	312	359
85	5	28	33	3	11	14	6	16	22	—	2	2	1	5	6	4	2	36	8	27	35	6	7	13	6	9	15	4	6	10	6	11	17	—	23	23	49	177	226
88	7	19	26	12	10	22	4	8	12	—	3	3	—	5	5	9	9	18	13	11	24	9	6	15	5	8	13	3	5	8	5	7	12	—	7	7	67	98	165
91	10	9	19	14	7	21	4	5	9	—	5	5	—	6	6	4	2	6	6	6	12	11	5	16	5	15	20	3	5	8	3	5	8	—	5	5	60	75	135
94	6	—	6	5	6	11	2	5	7	—	3	3	—	3	3	2	—	2	8	4	12	4	6	10	5	9	14	2	2	4	3	—	3	—	5	5	37	43	80
97	11	—	11	4	—	4	3	—	3	—	4	4	—	1	1	2	—	2	2	1	3	2	5	7	1	4	5	3	3	6	6	9	15	—	3	3	34	30	64
100	4	1	5	2	1	3	—	3	3	—	4	4	—	2	2	1	—	1	6	—	6	2	4	6	2	2	4	1	2	3	1	2	3	1	1	2	20	22	42
103	5	—	5	3	1	4	1	1	2	—	—	—	—	1	1	—	—	—	2	—	2	1	1	2	2	1	3	2	—	2	—	—	—	1	—	1	17	5	22
106	3	—	3	2	—	2	—	1	1	—	—	—	—	—	—	—	1	1	—	—	—	1	—	1	—	—	—	—	—	—	—	—	—	—	—	—	6	2	8
109	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	1	1	—	1	2	—	2	—	—	—	1	—	1	—	—	—	5	—	5
112	2	—	2	1	—	1	1	—	1	—	—	—	—	—	—	—	—	—	1	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	5	—	5
115	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	1
118	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
121	—	—	—	—	—	—	1	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	1
124	1	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	1
127	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
130	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
133	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
136	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Tot.	140	167	307	124	105	229	85	105	190	26	81	107	51	48	99	195	204	399	126	190	316	141	218	359	119	151	270	150	95	245	160	139	299	75	291	366	1,388	1,794	3,182

TABLE XVII.

Sea-Trout (Drag-net). Locality: Trondhjem. June 26—29, 1909.

Winters after Migration.		0					1					2						3			4			
Length in cm.	Number of Fish Examined.	Winters before Migration. Birth-year.					Winters before Migration. Birth-year.					Winters before Migration. Birth-year.						Winters before Migration. Birth-year.			Winters before Migration. Birth-year.			
		2	3	4	5	Tot.	2	3	4	5	Tot.	2	3	4	5	6	Tot.	3	4	Tot.	2	3	4	Tot.
		1907	1906	1905	1904		1906	1905	1904	1903		1905	1904	1903	1902	1901		1903	1902		1903	1902	1901	
21	1	—	1	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
22	4	1	3	—	—	4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
23	4	—	2	1	1	4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
24	8	—	—	1	1	2	3	1	2	—	6	—	—	—	—	—	—	—	—	—	—	—	—	—
25	5	—	—	—	—	—	1	3	1	—	5	—	—	—	—	—	—	—	—	—	—	—	—	—
26	7	—	—	—	—	—	1	5	1	—	7	—	—	—	—	—	—	—	—	—	—	—	—	—
27	13	—	—	—	1	1	1	5	5	—	11	—	1	—	—	—	1	—	—	—	—	—	—	—
28	13	—	—	—	1	1	3	4	5	—	12	—	—	—	—	—	—	—	—	—	—	—	—	—
29	15	—	—	—	1	1	1	8	5	—	14	—	—	—	—	—	—	—	—	—	—	—	—	—
30	11	—	—	—	1	1	—	5	4	1	10	—	—	—	—	—	—	—	—	—	—	—	—	—
31	20	—	—	1	1	2	2	6	9	1	18	—	—	—	—	—	—	—	—	—	—	—	—	—
32	10	—	—	—	1	1	—	—	6	1	7	—	1	1	—	—	2	—	—	—	—	—	—	—
33	13	—	—	—	—	—	—	2	4	2	8	3	2	—	—	—	5	—	—	—	—	—	—	—
34	13	—	—	—	—	—	—	3	2	1	6	2	4	1	—	—	7	—	—	—	—	—	—	—
35	7	—	—	—	—	—	—	3	—	—	3	1	3	—	—	—	4	—	—	—	—	—	—	—
36	7	—	—	—	—	—	2	2	2	—	6	1	—	—	—	—	1	—	—	—	—	—	—	—
37	6	—	—	—	—	—	—	—	2	—	2	1	3	—	—	—	4	—	—	—	—	—	—	—
38	5	—	—	—	—	—	—	—	—	1	1	—	3	1	—	—	4	—	—	—	—	—	—	—
39	1	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1	—	—	—	—	—	—	—
40	3	—	—	—	—	—	—	—	—	1	1	—	1	1	—	—	2	—	—	—	—	—	—	—
41	3	—	—	—	—	—	—	—	—	1	1	—	1	1	—	—	2	—	—	—	—	—	—	—
42	4	—	—	—	—	—	—	—	—	—	—	—	—	3	—	—	3	1	—	1	—	—	—	—
43	1	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	1	—	—	—	—	—	—	—
44	2	—	—	—	—	—	—	—	—	—	—	—	1	—	1	—	2	—	—	—	—	—	—	—
45	2	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	1	—	1	1	—	—	—	—
46	1	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	1	—	—	—	—	—	—	—
47	4	—	—	—	—	—	—	—	—	—	—	—	1	—	—	1	2	—	1	1	—	—	—	—
48	2	—	—	—	—	—	—	—	—	—	—	—	—	1	1	—	2	—	—	—	—	—	—	—
49	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	1
50	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
51	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	2	—	—	—	—
52	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
53	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
54	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1	2
55	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	1
56	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
57	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1
65	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	1
Tot.	192	1	6	3	8	18	14	47	48	9	118	8	22	10	4	1	45	1	4	5	2	2	2	6
Average length in cm.		22	22·7	26	28·0	25·4	28·4	29·6	30·3	34·7	30·1	34·4	36·5	40·5	45	47	38·8	—	—	47·2	—	—	—	55·7
Average weight in hgr.		0·9	1	1·8	2·2	1·6	2·4	2·6	2·7	3·8	2·7	3·7	5·1	6·5	8	—	5·6	—	—	11	—	—	—	14·8

TABLE XVIII.

Trout (caught with fly and worm). Locality: Daloselven, Ranen. Date: September 1—10, 1907.

Length in cm.	Number of Fish Examined.	2 winters.					3 winters.					4 winters.					5 winters.					6 winters.				
		♂		♀		Tot.	♂		♀		Tot.	♂		♀		Tot.	♂		♀		Tot.	♂		♀		Tot.
		m.	um.	m.	um.		m.	um.	m.	um.		m.	um.	m.	um.		m.	um.	m.	um.		m.	um.	m.	um.	
10	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
11	3	—	1	—	2	3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
12	9	—	5	—	4	9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
13	9	—	6	—	1	7	—	1	—	1	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
14	8	—	—	—	—	—	—	2	—	6	8	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
15	6	—	—	—	—	—	—	1	—	4	5	—	—	—	1	1	—	—	—	—	—	—	—	—	—	—
16	11	—	—	—	2	2	—	5	—	4	9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
17	3	—	—	—	—	—	—	—	—	1	1	1	1	—	—	2	—	—	—	—	—	—	—	—	—	—
18	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
19	5	—	—	—	—	—	—	—	—	—	—	2	—	—	—	2	3	—	—	—	3	—	—	—	—	—
20	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	—	—	—	2	—	—	—	—	—
21	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
22	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
23	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
24	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
25	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
Total .	59	—	12	—	9	21	—	9	—	16	25	3	1	—	1	5	5	—	—	—	5	3	—	—	—	3

In addition, 1 fish 33 cm. long ♂ ripe, 9 winters.

TABLE XIX.

Sea-Trout (Gill Nets and Seines). Locality: Utskarpen, Ranenfjord. Date: September 1—10, 1907.

Winters after Migration.		0				Tot.	1				Tot.	2				Tot.	3				Tot.	4				Tot.
Length in cm.	Number of Fish Examined.	♂		♀			♂		♀			♂		♀			♂		♀			♂		♀		
		m.	um.	m.	um.		m.	um.	m.	um.		m.	um.	m.	um.		m.	um.	m.	um.		m.	um.	m.	um.	
17	1	—	—	—	1	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
18	1	—	—	—	1	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
19	1	—	—	—	1	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
20	1	—	—	—	1	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
21	3	—	2	—	1	3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
22	2	—	1	—	1	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
23	2	—	1	—	1	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
24	6	2	2	—	2	6	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
25	4	—	2	—	2	4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
26	6	2	1	—	3	6	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
27	9	1	2	—	4	7	1	1	—	—	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
28	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
29	3	—	—	—	—	—	—	1	—	2	3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
30	4	—	—	—	1	1	2	—	—	1	3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
31	1	1	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
32	9	—	—	—	—	—	3	3	—	3	9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
33	2	—	—	—	1	1	—	—	1	1	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
34	1	—	—	—	—	—	—	—	—	1	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
35	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
36	2	—	—	—	—	—	1	1	—	—	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
37	5	—	—	—	—	—	1	—	1	1	3	—	2	—	—	2	—	—	—	—	—	—	—	—	—	—
38	3	—	—	—	—	—	—	1	1	—	2	1	—	—	—	1	—	—	—	—	—	—	—	—	—	—
39	1	—	—	—	—	—	—	—	—	—	—	—	—	1	—	1	—	—	—	—	—	—	—	—	—	—
40	1	—	—	—	—	—	1	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
41	2	—	—	—	—	—	—	—	—	—	—	—	—	2	—	2	—	—	—	—	—	—	—	—	—	—
42	5	—	—	—	—	—	—	—	—	—	—	1	—	4	—	5	—	—	—	—	—	—	—	—	—	—
43	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
44	1	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1	—	—	—	—	—	—	—	—	—	—
45	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
46	3	—	—	—	—	—	1	—	—	—	1	1	—	1	—	2	—	—	—	—	—	—	—	—	—	—
47	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
48	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	1	—	—	—	—	—
Total .	82	6	11	—	20	37	10	7	3	9	29	4	2	8	—	14	—	—	1	—	1	1	—	—	—	1
Average length in cm. . . .		24·3					33·3					41·4														

TABLE

Trout and Sea-Trout. Locality :

Length in cm.	Number of Fish examined.	Birth-Year. 1905 — 2 winters. ♂	♀	Tot.	*1905 — 2 winters.* ♂	♀	*Tot.*	1904 — 3 winters. ♂	♀	Tot.	*1904 — 3 winters.* ♂	♀	*Tot.*	1903 — 4 winters. ♂	♀	Tot.	*1903 — 4 winters.* ♂	♀	*Tot.*	1902 — 5 winters. ♂	♀	Tot.
10	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
11	3	1	2	3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
12	9	5	4	9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
13	9	6	1	7	—	—	—	1	1	2	—	—	—	—	—	—	—	—	—	—	—	—
14	8	—	—	—	—	—	—	2	6	8	—	—	—	—	—	—	—	—	—	—	—	—
15	6	—	—	—	—	—	—	1	4	5	—	—	—	—	1	1	—	—	—	—	—	—
16	11	—	2	2	—	—	—	5	4	9	—	—	—	—	—	—	—	—	—	—	—	—
17	4	—	—	—	—	*1*	*1*	—	1	1	—	—	—	2	—	2	—	—	—	—	—	—
18	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*1*	*1*	—	—	—
19	6	—	—	—	—	*1*	*1*	—	—	—	—	—	—	2	—	2	—	—	—	3	—	3
20	3	—	—	—	—	—	—	—	—	—	—	*1*	*1*	—	—	—	—	—	—	2	—	2
21	4	—	—	—	—	—	—	—	—	—	—	*1*	*1*	—	—	—	*2*	—	*2*	—	—	—
22	3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*1*	*2*	*3*	—	—	—
23	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*1*	—	*1*	—	—	—
24	6	—	—	—	—	—	—	—	—	—	*1*	*1*	*2*	—	—	—	*2*	—	*2*	—	—	—
25	5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*1*	*2*	*3*	—	—	—
26	6	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*2*	*3*	*5*	—	—	—
27	8	—	—	—	—	—	—	—	—	—	—	*1*	*1*	—	—	—	*4*	*1*	*5*	—	—	—
28	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
29	3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*1*	*1*	—	—	—
30	5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
31	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*1*	—	*1*	—	—	—
32	9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*1*	*1*	*2*	—	—	—
33	4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
34	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
35	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
36	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*1*	—	*1*	—	—	—
37	5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
38	3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
39	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
40	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
41	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
42	5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
43	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
44	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
45	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
46	3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	*1*	—	*1*	—	—	—
47	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
48	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Tot.	142	12	9	21		*2*	*2*	9	16	25	*1*	*4*	*5*	4	1	5	*17*	*11*	*28*	5		5
Average length in cm.		12·6 cm.			*18 cm.*			15 cm.			*22·8 cm.*			17·4 cm.			*25·7 cm.*			19·4 cm.		

Fish which have never been to the sea are printed in plain type.
Fish which have been to the sea in italics.

XX.

Utskarpen. Date: September 2—20, 1907.

1902			1901			*1901*			1900			*1900*			1899			*1899*			1898		
5 winters.			6 winters.			*6 winters.*			7 winters.			*7 winters.*			8 winters.			*8 winters.*			9 winters.		
♂	♀	*Tot.*	♂	♀	Tot.	♂	♀	*Tot.*	♂	♀	Tot.	♂	♀	*Tot.*	♂	♀	Tot.	♂	♀	*Tot.*	♂	♀	Tot.
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	1	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	1	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1	*1*	*2*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1	—	*1*	1	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1	—	*1*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1	*1*	*2*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1	*1*	*2*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2	*2*	*4*	—	—	—	—	*1*	*1*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
4	*2*	*6*	—	—	—	*1*	—	*1*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	*2*	*2*	—	—	—	—	*1*	*1*	—	—	—	—	—	—	—	—	—	—	—	—	1	—	1
—	*1*	*1*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1	—	*1*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2	*1*	*3*	—	—	—	*1*	*1*	*2*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	*2*	*1*	*3*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	*1*	*1*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	*1*	—	*1*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	*2*	*2*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1	—	*1*	—	—	—	—	*3*	*3*	—	—	—	—	*1*	*1*	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1	—	*1*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	*1*	—	—	—	—	*1*	*1*	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	1	—	—	—	—	—	—	*1*	*1*	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	*1*	*1*	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	*1*	*1*	—	—	—	—	—	—	—	—	—
16	*12*	*28*	3		3	*6*	*9*	*15*					*4*	*4*							1		1
32 cm.			23 cm.			*38·5 cm.*						*45·5 cm.*											

TABLE XXI.

Trout (fly). Locality: Aag-vand, Rødø, Nordre Helgeland.
Date: August 12th, 1908.

Birth-year.		1906			1905			1904			1903		1900	
Length in cm.	Number of Fish Examined.	2 winters.			3 winters.			4 winters.			5 winters.		8 winters.	
		♂	♀	Tot.	♂	♀	Tot.	♂	♀	Tot.	♂	Tot.	Tot.	
1	—	—	—	—	—	—	—	—	—	—	—	—	—	
2	—	—	—	—	—	—	—	—	—	—	—	—	—	
3	—	—	—	—	—	—	—	—	—	—	—	—	—	
4	—	—	—	—	—	—	—	—	—	—	—	—	—	
5	—	—	—	—	—	—	—	—	—	—	—	—	—	
6	—	—	—	—	—	—	—	—	—	—	—	—	—	
7	—	—	—	—	—	—	—	—	—	—	—	—	—	
8	—	—	—	—	—	—	—	—	—	—	—	—	—	
9	—	—	—	—	—	—	—	—	—	—	—	—	—	
10	1	—	1	1	—	—	—	—	—	—	—	—	—	
11	2	—	2	2	—	—	—	—	—	—	—	—	—	
12	3	1	2	3	—	—	—	—	—	—	—	—	—	
13	4	—	1	1	2	1	3	—	—	—	—	—	—	
14	6	—	—	—	4	2	6	—	—	—	—	—	—	
15	3	—	—	—	1	2	3	—	—	—	—	—	—	
16	3	—	—	—	1	1	2	—	1	1	—	—	—	
17	3	—	—	—	2	—	2	1	—	1	—	—	—	
18	2	—	—	—	1	1	2	—	—	—	—	—	—	
19	5	—	—	—	1	1	2	2	1	3	—	—	—	
20	1	—	—	—	—	—	—	1	—	1	—	—	—	
21	2	—	—	—	—	1	1	1	—	1	—	—	—	
22	2	—	—	—	1	—	1	1	—	1	—	—	—	
23	1	—	—	—	—	—	—	1	—	1	—	—	—	
24	2	—	—	—	—	—	—	1	—	1	1	1	—	
25	2	—	—	—	—	—	—	2	—	2	—	—	—	
26	—	—	—	—	—	—	—	—	—	—	—	—	—	
27	—	—	—	—	—	—	—	—	—	—	—	—	—	
28	—	—	—	—	—	—	—	—	—	—	—	—	—	
29	1	—	—	—	—	—	—	—	—	—	1	1	—	
Tot.	43	1	6	7	13	9	22	10	2	12	2	2	(1)	
Average length in cm.			11·6			16			20·8			—	—	

1 Fish 57 cm. 4 winters in river, 4 winters in sea.

TABLE XXII.

Trout (fly). Locality: Kvern-vand, Nærø. Date: July 6th, 1909.

Birth-year.		1907			1906			1905			1904	
Length in cm.	Number of Fish Examined.	2 winters.			3 winters.			4 winters.			5 winters.	
		♂	♀	Tot.	♂	♀	Tot.	♂	♀	Tot.	♀	Tot.
15	2	1	1	2	—	—	—	—	—	—	—	—
16	1	—	1	1	—	—	—	—	—	—	—	—
17	3	—	3	3	—	—	—	—	—	—	—	—
18	4	1	1	2	—	2	2	—	—	—	—	—
19	5	2	3	5	—	—	—	—	—	—	—	—
20	11	4	3	7	—	4	4	—	—	—	—	—
21	12	4	2	6	2	4	6	—	—	—	—	—
22	13	1	—	1	3	8	11	—	1	1	—	—
23	7	—	—	—	3	4	7	—	—	—	—	—
24	16	—	—	—	2	9	11	1	4	5	—	—
25	9	—	—	—	1	3	4	1	4	5	—	—
26	4	—	—	—	1	—	1	—	3	3	—	—
27	1	—	—	—	—	—	—	—	1	1	—	—
28	3	—	—	—	—	—	—	1	1	2	1	1
29	2	—	—	—	—	—	—	1	—	1	1	1
30	1	—	—	—	—	—	—	—	1	1	—	—
31	—	—	—	—	—	—	—	—	—	—	—	—
32	—	—	—	—	—	—	—	—	—	—	—	—
33	—	—	—	—	—	—	—	—	—	—	—	—
34	1	—	—	—	—	—	—	—	—	—	1	1
Tot.	95	13	14	27	12	34	46	4	15	19	3	3
Average length in cm.		19·1			22·5			25·6			30·3	

TABLE XXIIB.

Trout. Locality: Kvern-vand, Nærø. Date: July 6th, 1909.

L.-No.	Length in cm.	Weight.	Sex.	State of Sexual organs.	Age in Winter.	Calculated length at formation of winter-band.						
						1st	2nd	3rd	4th	5th	6th	7th
1	15	35	♂	2	2	5·0	11·0	—	—	—	—	—
2	,,	,,	♀	—	2	4·0	12·1	—	—	—	—	—
3	16	40	♂	—	2	4·0	11·0	—	—	—	—	—
4	17	50	♀	3	2	4·3	13·0	—	—	—	—	—
5	,,	,,	,,	—	2	5·1	13·9	—	—	—	—	—
6	,,	,,	,,	—	2	3·5	12·6	—	—	—	—	—
7	18	60	♂	—	3	3·8	10·0	14·4	—	—	—	—
8	,,	65	,,	2	2	6·3	15·5	—	—	—	—	—
9	,,	50	♀	—	2	6·7	15·3	—	—	—	—	—
10	,,	60	,,	—	3	3·8	8·3	14·5	—	—	—	—
11	19	,,	♂	3	2	6·7	16·2	—	—	—	—	—
12	,,	,,	,,	—	2	5·4	16·5	—	—	—	—	—
13	,,	,,	♀	—	2	5·2	16·7	—	—	—	—	—
14	,,	,,	,,	—	2	4·6	15·2	—	—	—	—	—
15	,,	65	,,	—	2	6·9	16·4	—	—	—	—	—
16	20	70	♂	—	2	7·0	16·0	—	—	—	—	—
17	,,	,,	,,	—	2	7·0	17·6	—	—	—	—	—
18	,,	75	,,	—	2	7·4	16·6	—	—	—	—	—
19	,,	,,	,,	—	2	7·3	17·4	—	—	—	—	—
20	,,	70	♀	—	3	5·2	12·5	16·3	—	—	—	—
21	,,	,,	,,	—	2	5·7	14·9	—	—	—	—	—
22	,,	,,	,,	—	3	3·7	10·0	16·2	—	—	—	—
23	,,	,,	,,	—	3	3·8	11·0	16·7	—	—	—	—
24	,,	,,	,,	—	2	6·2	15·5	—	—	—	—	—
25	,,	,,	,,	—	3	3·7	10·5	16·0	—	—	—	—
26	,,	75	,,	—	2	4·9	16·0	—	—	—	—	—
27	21	70	♂	—	2	6·8	17·4	—	—	—	—	—
28	,,	80	,,	—	2	6·7	17·6	—	—	—	—	—
29	,,	,,	,,	—	3	4·0	12·0	18·5	—	—	—	—
30	,,	85	,,	—	2	7·2	17·6	—	—	—	—	—
31	,,	90	,,	—	2	6·8	17·0	—	—	—	—	—
32	,,	,,	,,	2	3	5·2	12·9	18·0	—	—	—	—
33	,,	80	♀	—	2	7·0	16·8	—	—	—	—	—
34	,,	80	,,	—	3	4·2	11·5	18·2	—	—	—	—
35	,,	,,	,,	2	3	2·2	7·9	18·0	—	—	—	—
36	,,	,,	♂	—	3	2·5	9·4	16·0	—	—	—	—
37	,,	85	♀	—	2	7·8	17·2	—	—	—	—	—
38	,,	,,	,,	2	3	5·0	11·7	19·6	—	—	—	—
39	22	80	♂	—	2	7·5	18·6	—	—	—	—	—
40	,,	90	,,	—	3	3·3	10·7	19·8	—	—	—	—
41	,,	95	,,	—	3	5·5	14·7	21·1	—	—	—	—
42	,,	,,	,,	—	3	5·9	12·4	20·0	—	—	—	—
43	,,	80	♀	—	3	6·5	12·2	20·2	—	—	—	—
44	,,	85	,,	—	4	5·4	9·0	12·8	20·9	—	—	—
45	,,	90	,,	—	3	3·8	11·8	20·0	—	—	—	—
46	,,	95	,,	2	3	4·7	12·9	20·7	—	—	—	—

TABLE XXIIB.—*continued.*

Trout. Locality: Kvern-vand. Nærø. Date: July 6th, 1909.

L.-No.	Length in cm.	Weight.	Sex.	State of Sexual organs.	Age.	Calculated length at formation of winter band.						
						1st	2nd	3rd	4th	5th	6th	7th
47	22	100	♀	—	3	4·2	10·8	19·0	—	—	—	—
48	,,	,,	,,	1—2	3	5·0	12·8	18·9	—	—	—	—
49	,,	,,	,,	2	3	6·4	15·5	19·4	—	—	—	—
50	,,	,,	,,	—	3	4·3	12·9	19·5	—	—	—	—
51	,,	105	,,	—	3	3·6	10·6	19·6	—	—	—	—
52	23	100	♂	—	3	4·4	12·3	20·3	—	—	—	—
53	,,	105	,,	—	3	9·1	16·5	21·5	—	—	—	—
54	,,	110	,,	3	3	7·0	17·0	21·2	—	—	—	—
55	,,	,,	♀♂	—	3	4·7	12·6	20·9	—	—	—	—
56	,,	,,	,,	3	3	5·3	16·4	21·1	—	—	—	—
57	,,	115	,,	2	3	7·5	14·8	21·2	—	—	—	—
58	,,	120	,,	3—4	3	5·2	14·6	21·7	—	—	—	—
59	24	130	♂	2	3	4·6	13·8	21·2	—	—	—	—
60	,,	135	,,	3	4	5·0	13·0	19·7	22·5	—	—	—
61	,,	145	,,	2	3	3·5	12·5	22·7	—	—	—	—
62	,,	110	♀	3	4	5·0	14·3	20·8	23·3	—	—	—
63	,,	,,	,,	—	3	4·5	13·8	23·0	—	—	—	—
64	,,	,,	,,	3	3	7·8	15·4	22·2	—	—	—	—
65	,,	,,	,,	1—2	4	4·8	13·9	19·8	22·7	—	—	—
66	,,	115	,,	1—2	3	7·6	14·8	22·4	—	—	—	—
67	,,	120	,,	3	3	6.3	15·0	22·7	—	—	—	—
68	,,	,,	,,	3	3	4·1	15·2	22·0	—	—	—	—
69	,,	,,	,,	2	4	7·6	16·5	21·5	22·9	—	—	—
70	,,	,,	,,	—	3	5·6	16·6	22·6	—	—	—	—
71	,,	,,	,,	3	4	4·2	11·2	16·2	22·2	—	—	—
72	,,	130	♂	2	3	7·2	17·4	21·8	—	—	—	—
73	,,	,,	♀♂	2—3	3	7·0	15·2	22·5	—	—	—	—
74	,,	135	♂	3	3	7·2	19·3	22·5	—	—	—	—
75	25	130	,,	—	4	4·8	10·7	18·5	23·4	—	—	—
76	,,	145	,,	3	3	5·6	16·5	23·2	—	—	—	—
77	,,	120	♀	—	3	4·5	13·4	23·1	—	—	—	—
78	,,	125	,,	—	3	5·2	13·8	22·7	—	—	—	—
79	,,	130	,,	3	4	5·9	14·7	20·7	23·6	—	—	—
80	,,	,,	,,	3	4	4·7	12·5	20·7	24·0	—	—	—
81	,,	,,	♂	2	3	7·4	18·7	24·2	—	—	—	—
82	,,	135	,,	2	4	5·2	13·5	20·2	24·5	—	—	—
83	,,	140	♀	3	4	7·6	17·5	20·1	24·0	—	—	—
84	26	125	♂	—	3	5·1	15·3	25·1	—	—	—	—
85	,,	115	,,	2	4	7·3	12·0	17·7	25·4	—	—	—
86	,,	140	♀	3	4	5·4	14·3	20·5	25·3	—	—	—
87	,,	160	,,	1—2	4	3·6	9·0	17·7	24·3	—	—	—
88	27	170	♂	3	4	5·5	15·0	20·4	26·5	—	—	—
89	28	190	,,	3	4	6·0	13·3	21·5	26·4	—	—	—
90	,,	170	♀♂	1—2	4	5·5	13·4	21·3	27·0	—	—	—
91	,,	200	,,	3	5	4·3	13·4	20·4	24·2	27·1	—	—
92	29	,,	,,	2	4	8·2	18·5	24·3	27·6	—	—	—
93	,,	175	♀	1—2	5	7·2	9·8	19·7	25·4	28·4	—	—
94	30	245	,,	3	4	7·5	14·0	21·3	27·0	—	—	—
95	34	315	,,	2	3	5·5	10·7	20·3	25·7	31·2	—	—

TABLE XXIII.

Trout (Fly). Locality: Mølnbugtelv, Agdenes. Date: July 4th, 1909.

Birth-Year.		1908			1907			1906			1905			1904		
Length in cm.	Number of Fish examined.	1 winter.			2 winters.			3 winters.			4 winters.			5 winters.		
		♂	♀	Tot.	♂	♀	Tot.	♂	♀	Tot.	♂	♀	Tot.	♂	♀	Tot.
12	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
13	6	3	3	6	—	—	—	—	—	—	—	—	—	—	—	—
14	6	3	3	6	—	—	—	—	—	—	—	—	—	—	—	—
15	1	—	1	1	—	—	—	—	—	—	—	—	—	—	—	—
16	1	—	—	—	—	1	1	—	—	—	—	—	—	—	—	—
17	5	—	—	—	3	2	5	—	—	—	—	—	—	—	—	—
18	9	—	—	—	4	5	9	—	—	—	—	—	—	—	—	—
19	10	—	—	—	5	5	10	—	—	—	—	—	—	—	—	—
20	7	—	—	—	3	4	7	—	—	—	—	—	—	—	—	—
21	5	—	—	—	2	2	4	—	1	1	—	—	—	—	—	—
22	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
23	4	—	—	—	1	1	2	2	—	2	—	—	—	—	—	—
24	2	—	—	—	—	1	1	—	—	—	1	—	1	—	—	—
25	2	—	—	—	—	—	—	—	—	—	1	1	2	—	—	—
26	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
27	1	—	—	—	—	—	—	—	—	—	1	—	1	—	—	—
28	1	—	—	—	—	—	—	—	—	—	1	—	1	—	—	—
29	1	—	—	—	—	—	—	—	—	—	—	—	—	1	—	1
30	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
30	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
32	2	—	—	—	—	—	—	—	—	—	—	—	—	1	—	1
33	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	62	6	7	13	18	21	39	2	1	3	4	1	5	2	—	2
Average length in cm.		13·6			19·3			22·3			25·8			30·5		
Average length same place, July 9, 1908[1]		13·9 (29)[2]			17·5 (10)			22·7 (5)			25·7 (3)			28·6 (1)		

[1] In fish at corresponding age.
[2] Number of individuals in brackets.

TABLE XXIIIB.

Trout. Locality: Mølnbugtelv, Agdenes. Date: July 4th, 1909.

L. No.	Length in cm.	Weight.	Sex.	State of Sex org.	Age in Winters.	Calculated length at formation of winter-band.				
						1st	2nd	3rd	4th	5th
1	13	20	♂	—	1	7·3	—	—	—	—
2	,,	22	,,	—	1	6·5	—	—	—	—
3	,,	25	,,	—	1	7·9	—	—	—	—
4	,,	19	♀	—	1	5·5	—	—	—	—
5	,,	25	,,	—	1	6·7	—	—	—	—
6	,,	28	,,	—	1	7·2	—	—	—	—
7	14	27	♂	—	1	7·1	—	—	—	—
8	,,	28	,,	—	1	7·2	—	—	—	—
9	,,	30	,,	—	1	7·7	—	—	—	—
10	,,	28	♀	—	1	7·3	—	—	—	—
11	,,	30	,,	—	1	7·7	—	—	—	—
12	,,	30	,,	—	1	7·6	—	—	—	—
13	15	32	,,	—	1	6·1	—	—	—	—
14	16	42	,,	—	2	3·4	10·4	—	—	—
15	17	46	♂	—	2	4·7	13·1	—	—	—
16	,,	50	,,	—	2	5·7	12·6	—	—	—
17	,,	55	,,	—	2	5·0	12·5	—	—	—
18	,,	46	♀	—	2	4·3	12·4	—	—	—
19	,,	50	,,	—	2	4·6	12·0	—	—	—
20	18	52	♂	2	2	4·8	13·1	—	—	—
21	,,	55	,,	—	2	6·6	13·5	—	—	—
22	,,	60	,,	—	2	4·7	12·7	—	—	—
23	,,	65	,,	2	2	4·1	13·1	—	—	—
24	,,	54	♀	2	2	5·6	13·7	—	—	—
25	,,	55	,,	—	2	6·0	14·0	—	—	—
26	,,	55	,,	—	2	4·0	12·2	—	—	—
27	,,	58	,,	—	2	5·2	12·3	—	—	—
28	,,	60	,,	—	2	5·8	13·0	—	—	—
29	19	58	♂	—	2	5·0	14·3	—	—	—
30	,,	65	,,	—	2	5·7	13·4	—	—	—
31	,,	70	,,	—	2	6·5	12·4	—	—	—
32	,,	70	,,	2	2	6·0	15·0	—	—	—
33	,,	70	,,	2	2	6·0	16·0	—	—	—
34	,,	61	♀	—	2	5·0	14·2	—	—	—
35	,,	62	,,	—	2	5·8	15·9	—	—	—
36	,,	65	,,	—	2	6·3	15·0	—	—	—
37	,,	68	,,	—	2	4·7	13·4	—	—	—
38	,,	70	,,	3	2	8·4	15·8	—	—	—
39	20	55	♂	—	2	8·3	17·0	—	—	—
40	,,	60	,,	—	2	7·3	16·9	—	—	—
41	,,	73	,,	—	2	8·0	17·2	—	—	—
42	,,	75	♀	—	2	7·1	16·7	—	—	—
43	,,	75	,,	3	2	9·3	17·6	—	—	—
44	,,	75	,,	2	2	6·7	18·0	—	—	—
45	,,	80	,,	—	2	7·2	16·2	—	—	—

TABLE XXIIIB—*continued.*

Trout. Locality: Mølnbugtelv, Agdenes. Date: July 4th, 1909.

L.-No.	Length in cm.	Weight.	Sex.	State of Sex org.	Age in Winters.	Calculated length at formation of winter band.				
						1st	2nd	3rd	4th	5th
46	21	82	♂	—	2	5·7	16·2	—	—	—
47	,,	90	,,	—	2	6·6	17·3	—	—	—
48	,,	70	♀	—	2	9·2	19·4	—	—	—
49	,,	75	,,	—	3	4·8	9·9	18·4	—	—
50	,,	85	,,	2	2	5·5	14·9	—	—	—
51	23	110	♂	—	2	8·1	16·7	—	—	—
52	,,	110	,,	2	3	7·5	18·2	21·2	—	—
53	,,	115	,,	3	3	4·7	13·7	19·3	—	—
54	,,	125	♀	2	2	8·1	17·9	—	—	—
55	24	120	♂	3	4	5·7	14·3	15·7	22·3	—
56	,,	145	♀	2	2	7·9	21·3	—	—	—
57	25	160	♂	3	4	5·7	13·4	19·8	22·3	—
58	,,	140	♀	3	4	6·2	13·2	19·5	22·9	—
59	27	150	♂	2	4	7·8	19·2	23·2	25·8	—
60	28	150	,,	2	4	5·9	17·6	22·6	26·3	—
61	29	230	,,	3	5	5·4	13·0	18·4	25·3	27·7
62	32	300	,,	3	5	6·9	16·2	22·7	26·9	30·6
				Total . .		391·3	727·7	200·8	171·8	58·3
				Average . .		6·3	14·9	20·1	24·5	29·2

TABLE XXIV.

Trout.[1] Locality: (Os-River 1). Tysdalsvand. Date: May 15—18, 1909.

Birth-Year.		1907			1906			1905			1904			1903			1902		
Length in cm.	No. of Fish examined.	2 winters.			3 winters.			4 winters.			5 winters.			6 winters.			7 winters.		
		♂	♀	Tot.	♂	♀	Tot.	♂	♀	Tot.	♂	♀	Tot.	♂	♀	Tot.	♂	♀	Tot.
15	6	1	4	5	—	1	1	—	—	—	—	—	—	—	—	—	—	—	—
16	4	—	—	—	2	2	4	—	—	—	—	—	—	—	—	—	—	—	—
17	5	—	—	—	2	3	5	—	—	—	—	—	—	—	—	—	—	—	—
18	1	—	—	—	—	—	—	—	1	1	—	—	—	—	—	—	—	—	—
19	9	—	—	—	4	—	4	3	2	5	—	—	—	—	—	—	—	—	—
20	9	—	—	—	3	2	5	2	2	4	—	—	—	—	—	—	—	—	—
21	9	—	—	—	2	2	4	—	3	3	1	1	2	—	—	—	—	—	—
22	8	—	—	—	2	—	2	2	1	3	1	—	1	2	—	2	—	—	—
23	4	—	—	—	—	1	1	1	—	1	1	—	1	—	—	—	1	—	1
24	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
25	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
26	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
27	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
28	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
29	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Tot.	55	1	4	5	15	11	26	8	9	17	3	1	4	2	—	2	1	—	1

[1] Taken with fly.

TABLE XXV.

Trout.[1] Locality: Os-River 2. Bergstøvand, Outlet, Stor-Strommen.
Date: May 19, 1909.

Birth-Year.		1908			1907			1906			1905			1904		
Length in cm.	Number of fish examined.	1 winter.			2 winters.			3 winters.			4 winters.			5 winters.		
		♂	♀	Tot.	♂	♀	Tot.	♂	♀	Tot.	♂	♀	Tot.	♂	♀	Tot.
5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
6	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
7	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
8	2	2	—	2	—	—	—	—	—	—	—	—	—	—	—	—
9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
10	1	1	—	1	—	—	—	—	—	—	—	—	—	—	—	—
11	3	1	—	1	1	1	2	—	—	—	—	—	—	—	—	—
12	9	—	—	—	3	6	9	—	—	—	—	—	—	—	—	—
13	20	—	—	—	9	10	19	—	1	1	—	—	—	—	—	—
14	17	—	—	—	7	9	16	1	—	1	—	—	—	—	—	—
15	28	—	—	—	12	8	20	7	—	7	1	—	1	—	—	—
16	12	—	—	—	2	2	4	4	1	5	3	—	3	—	—	—
17	13	—	—	—	2	—	2	7	3	10	1	—	1	—	—	—
18	8	—	—	—	1	—	1	3	2	5	1	1	2	—	—	—
19	9	—	—	—	—	—	—	5	1	6	2	1	3	—	—	—
20	6	—	—	—	—	—	—	2	1	3	1	1	2	—	1	1
21	9	—	—	—	—	—	—	1	2	3	2	3	5	1	—	1
22	7	—	—	—	—	—	—	1	2	3	2	1	3	1	—	1
23	5	—	—	—	—	—	—	1	—	1	1	—	1	3	—	3
24	5	—	—	—	—	—	—	—	—	—	2	1	3	—	2	2
25	1	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1
26	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
27	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
28	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
29	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
30	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
31	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
32	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Tot.	155	4	—	4	37	36	73	32	13	45	16	8	24	5	4	9
Average length in cm.		9·5 cm.			13·9 cm.			17·7 cm.			20 cm.			22·8 cm.		

[1] Taken with fine-meshed seine.

TABLE XXVI.

Trout.[1] Locality: Os-River 3. Bergstøvand, River Mouth at Sand.
Date: May 10th, 1909.

Birth-year.		1908			1907			1906			1905			1904		
Length in cm.	Number of Fish Examined.	1 winter.			2 winters.			3 winters.			4 winters.			5 winters.		
		♂	♀	Tot.	♂	♀	Tot.	♂	♀	Tot.	♂	♀	Tot.	♂	♀	Tot.
5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
6	1	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—
7	3	—	—	3	—	—	—	—	—	—	—	—	—	—	—	—
8	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
9	2	1	—	1	—	1	1	—	—	—	—	—	—	—	—	—
10	1	—	—	—	1	—	1	—	—	—	—	—	—	—	—	—
11	10	—	—	—	8	2	10	—	—	—	—	—	—	—	—	—
12	3	—	—	—	3	—	3	—	—	—	—	—	—	—	—	—
13	16	—	—	—	6	7	13	1	2	3	—	—	—	—	—	—
14	11	—	—	—	4	3	7	3	1	4	—	—	—	—	—	—
15	10	—	—	—	5	4	9	—	1	1	—	—	—	—	—	—
16	15	—	—	—	1	4	5	6	4	10	—	—	—	—	—	—
17	11	—	—	—	1	—	1	4	6	10	—	—	—	—	—	—
18	7	—	—	—	—	—	—	5	2	7	—	—	—	—	—	—
19	9	—	—	—	—	—	—	1	3	4	2	2	4	1	—	1
20	7	—	—	—	—	—	—	2	1	3	2	2	4	—	—	—
21	6	—	—	—	—	—	—	1	1	2	2	2	4	—	—	—
22	5	—	—	—	—	—	—	—	—	—	3	2	5	—	—	—
23	4	—	—	—	—	—	—	—	—	—	2	2	4	—	—	—
24	8	—	—	—	—	—	—	—	—	—	2	2	4	1	3	4
25	2	—	—	—	—	—	—	—	—	—	1	—	1	1	—	1
26	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
27	1	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1
28	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
29	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
30	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
31	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
32	1	—	—	—	—	—	—	—	—	—	—	—	—	1	—	1
Tot.	132	1	—	5	29	21	50	23	21	44	14	12	26	4	4	8
Average length in cm.		7·2			13·3			16·9			21·7			24·9		

[1] Taken with fine-meshed seine.

TABLE

Trout. Locality: Laagen, Lillehammer.

Winters after Migration.		1				2			3				4				5	
Length in cm.	Number of Fish Examined.	Winters before Migration. Birth-year.				Winters before Migration. Birth-year.			Winters before Migration. Birth-year.				Winters before Migration. Birth-year.				Winters before Migration. Birth-year.	
		4	5	6	Tot.	5	6	Tot.	4	5	6	Tot.	4	5	6	Tot.	4	5
		1904	1903	1902		1902	1901		1902	1901	1900		1901	1900	1899		1900	1899
43	3	1	2	—	3	—	—	—	—	—	—	—	—	—	—	—	—	—
46	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
49	5	—	—	2	2	2	—	2	1	—	—	1	—	—	—	—	—	—
52	4	—	—	1	1	1	—	1	2	—	—	2	—	—	—	—	—	—
55	13	—	—	—	—	4	1	5	4	2	—	6	—	2	—	2	—	—
58	8	—	—	—	—	2	—	2	3	2	—	5	1	—	—	1	—	—
61	24	—	—	—	—	—	1	1	8	6	3	17	5	1	—	6	—	—
64	16	—	—	—	—	—	—	—	3	7	2	12	3	—	—	3	—	1
67	16	—	—	—	—	—	—	—	1	4	1	6	6	3	—	9	—	—
70	21	—	—	—	—	—	—	—	—	2	3	5	9	4	1	14	—	—
73	12	—	—	—	—	—	—	—	—	1	—	1	2	8	—	10	(1)	—
76	11	—	—	—	—	—	—	—	—	—	—	—	3 (1)	3	1	7 (1)	—	2
79	8	—	—	—	—	—	—	—	—	—	—	—	1	2	—	3	1	2 (1)
82	6	—	—	—	—	—	—	—	—	—	—	—	—	2 (1)	1	3 (1)	—	(1)
85	8	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	(1)
88	5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
91	7	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
94	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
97	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
100	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Tot.	171	1	2	3	6	9	2	11	22	24	9	55	30 (1)	25 (1)	3	58 (2)	3 (1)	6 (3)
Average length in cm.		43	43·5	49·9	46·5	54·2	58·5	55	59	63·4	65·8	62	67·5	71·6	75·7	69·7	—	—

XXVII.

Date: June 25th—September 3rd, 1909.

5		6					7					8			9		11	
Winters before Migration. Birth-year.		Winters before Migration. Birth-year.					Winters before Migration. Birth-year.					Winters before Migration. Birth-year.			Winters before Migration. Birth-year.		Winters before Migration. Birth-year.	
6		3	4	5	6		3	4	5	6		4	5		5		4	
1898	Tot.		1899	1898		Tot.	1899		1897	1896	Tot.	1897	1896	Tot.	1895	Tot.	1894	Tot
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	(1)	1	—	1 (1)	—	—	—	—	—	—	—	—	—	—	—	—
—	(1)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	2	—	—	—	—	—	(1)	—	—	—	(1)	—	—	—	—	—	—	—
—	3 (1)	—	—	(1)	—	(1)	—	—	—	—	—	—	—	—	—	—	—	—
—	(1)	—	—	(1)	—	(1)	—	—	—	—	—	—	—	—	—	—	—	—
—	2 (1)	—	2	1 (2)	—	3 (2)	—	—	—	—	—	—	—	—	—	—	—	—
—	1	1	1	2	—	4	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	(1)	1	1 (1)	1 (1)	1 (1)	2 (2)	(1)	(1)	—	—
—	—	—	—	—	—	—	—	—	1	—	1	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	1 (1)	1 (1)	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(1)	(1)
1	10 (4)	1	3 (1)	4 (4)	—	8 (5)	(1)	—	1 (1)	1	2 (2)	1 (1)	2 (2)	3 (3)	(1)	(1)	(1)	(1)
—	77·5	—	—	—	—	84·1	—	—	—	—	92·5	—	—	93·3	—	—	—	—

TABLE

Trout. Locality: Laagen, Lillehammer.

Winters after migration.		1				2			3				4			
Weight in hektogrs.	Number of fish examined.	Winters before migration. Birth-year.				Winters before migration. Birth-year.			Winters before migration. Birth-year.				Winters before migration. Birth-year.			
		4	5	6	Tot.	5	6	Tot.	4	5	6	Tot.	4	5	6	Tot.
		1904	1903	1902		1902	1901		1902	1901	1900		1901	1900	1899	
7	3	2	1	—	3	—	—	—	—	—	—	—	—	—	—	—
14	10	—	—	3	3	3	—	3	4	—	—	4	—	—	—	—
21	21	—	—	—	—	6	1	7	7	3	—	10	2	2	—	4
28	36	—	—	—	—	—	1	1	9	13	3	25	7	1	—	8
35	22	—	—	—	—	—	—	—	2	6	2	10	8	3	—	11
42	23	—	—	—	—	—	—	—	—	2	4	6	6	8	1	15
49	12	—	—	—	—	—	—	—	—	—	—	—	5(1)	2	1	8(1)
56	11	—	—	—	—	—	—	—	—	—	—	—	—	6	—	6
63	5	—	—	—	—	—	—	—	—	—	—	—	2	1	—	3
70	7	—	—	—	—	—	—	—	—	—	—	—	—	1(1)	1	2(1)
77	6	—	—	—	—	—	—	—	—	—	—	—	—	1	—	1
84	4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
91	4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
98	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
105	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
112	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
119	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Tot.	171	2	1	3	6	9	2	11	22	24	9	55	30 (1)	25 (1)	3	58 (2)
Average weight in hektograms.		9	10	14	11·7	18·1	22·5	18·9	25·1	29·6	34·3	28·1	36·7	45·3	53	41·9

XXVIIB.

Date: June 25th—September 3rd, 1909.

5				6				7					8			9		11	
Winters before migration. Birth-year.				Winters before migration Birth-year.				Winters before migration. Birth-year.					Winters before migration. Birth-year.			Winters before migra-tion. Birth-year.		Winters before migra-tion. Birth-year.	
4	5	6	Tot.	3	4	5	Tot.	3	4	5	6	Tot.	4	5	Tot.	5	Tot.	4	Tot.
1900	1899	1898		1900	1899	1898		1899		1897	1896		1897	1896		1895		1894	
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	1	1	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	1	1	—	—	—	—	—	—	—	—	—	—	—	—
(1)	—	—	(1)	—	(1)	—	(1)	—	—	—	—	—	—	—	—	—	—	—	—
—	1 (1)	—	1 (1)	—	—	—	—	(1)	—	—	—	(1)	—	—	—	—	—	—	—
—	2 (1)	—	2 (1)	—	—	(1)	(1)	—	—	—	—	—	—	—	—	—	—	—	—
1	—	—	1	—	—	(2)	(2)	—	—	—	—	—	—	—	—	—	—	—	—
1	1	—	2	—	—	(1)	(1)	—	—	—	—	—	—	(1)	(1)	—	—	—	—
—	1 (1)	—	1 (1)	1	—	1	2	—	—	—	—	—	—	—	—	(1)	(1)	—	—
—	—	—	—	—	3	—	3	—	—	—	—	—	(1)	—	(1)	—	—	—	—
1	—	—	1	—	—	—	—	—	—	—	1	1	1	1	2	—	—	—	—
—	—	—	—	—	—	1	1	—	—	1	—	1	—	—	—	—	—	—	—
—	—	—	—	—	—	1	1	—	—	(1)	—	(1)	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	(1)	(1)	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1	—	—	(1)	(1)
3 (1)	6 (3)	1	10 (2)	1	3 (1)	4 (4)	8 (5)	(1)	—	1 (1)	1	2 (2)	1 (1)	2 (2)	3 (3)	(1)	(1)	(1)	(1)
—	—	—	59·0	—	—	—	81·1	—	—	—	—	93·5	—	—	99	—	—	—	—

TABLE XXVIIc.

Trout.[1] Locality: Laagen, Lillehammer. Date: June 26—September 3, 1909.

L.-No.	Date.	Length in cm.	Weight in Kgr.	Sex.	Winters Before Altered Growth.	Winters After Altered Growth.	Calculated Length at Formation of Winter-band.														
							1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th	13th	14th	15th
1	Aug. 15	43	0·80	♀	4	1	5·0	9·0	16·5	22·0	38·0	—	—	—	—	—	—	—	—	—	—
2	Aug. 4	,,	0·95	,,	5	1	5·5	11·5	17·0	22·0	26·0	39·5	—	—	—	—	—	—	—	—	—
3	Aug. 4	44	0·90	,,	5	1	5·5	11·5	17·0	23·0	25·5	40·5	—	—	—	—	—	—	—	—	—
4	Aug. 4	47	1·00	,,	12	0	3·5	6·0	8·5	11·0	14·5	18·5	26·0	37·0	40·0	43·5	45·0	46·0	—	—	—
5	Aug. 13	48	1·15	♂	6	1	6·5	12·0	16·0	21·0	26·0	33·0	44·5	—	—	—	—	—	—	—	—
6	Aug. 13	,,	1·25	♀	6	1	4·0	8·0	16·0	23·0	27·0	30·0	44·5	—	—	—	—	—	—	—	—
7	Aug. 5	49	1·20	,,	7	0	6·5	13·0	20·0	32·0	39·5	44·0	47·5	—	—	—	—	—	—	—	—
8	Aug. 12	,,	1·25	,,	5	2	5·0	9·5	16·0	20·0	25·5	37·5	47·0	—	—	—	—	—	—	—	—
9	Aug. 13	50	1·50	♂	5	2	7·5	12·0	17·0	25·0	29·5	41·0	46·5	—	—	—	—	—	—	—	—
10	July 26	,,	1·45	♀	4	3	6·0	14·0	19·0	24·5	34·5	44·5	48·5	—	—	—	—	—	—	—	—
11	Aug. 6	52	1·50	,,	5	2	5·0	11·0	16·5	21·5	26·5	36·5	47·5	—	—	—	—	—	—	—	—
12	Aug. 15	53	1·60	♂	4	3	5·5	11·0	16·0	23·0	35·5	42·5	50·0	—	—	—	—	—	—	—	—
13	Aug. 15	,,	1·70	♀	6	1	4·0	7·0	14·0	21·0	26·5	35·5	49·0	—	—	—	—	—	—	—	—
14	Aug. 15	,,	,,	,,	4	3	5·0	9·5	13·5	20·0	31·5	37·5	50·5	—	—	—	—	—	—	—	—
15	Aug. 13	54	1·50	,,	4	3	5·5	12·0	17·0	23·0	35·5	44·0	52·0	—	—	—	—	—	—	—	—
16	Aug. 13	55	1·75	,,	5	3	5·5	11·0	15·0	19·0	23·5	34·5	43·5	53·0	—	—	—	—	—	—	—
17	July 21	,,	1·80	,,	4	3	6·5	13·5	19·5	26·0	35·0	43·0	52·5	—	—	—	—	—	—	—	—
18	Aug. 16	,,	,,	,,	4	3	5·5	10·0	16·5	23·0	36·0	44·0	53·5	—	—	—	—	—	—	—	—
19	July 22	,,	,,	,,	5	2	7·0	14·0	19·5	26·0	30·0	41·0	53·0	—	—	—	—	—	—	—	—
20	Aug. 2	,,	,,	,,	5	2	6·0	11·5	16·0	23·0	29·0	41·0	50·5	—	—	—	—	—	—	—	—
21	July 22	,,	1·85	,,	5	4	5·0	10·0	15·0	19·0	23·5	34·0	40·0	45·0	52·5	—	—	—	—	—	—
22	Aug. 13	56	1·75	♂	6	2	5·5	9·0	12·0	18·5	23·0	27·0	37·5	53·5	—	—	—	—	—	—	—
23	Aug. 15	,,	1·90	,,	5	2	6·5	10·5	19·0	25·5	29·5	38·5	52·0	—	—	—	—	—	—	—	—
24	Aug. 15	,,	2·00	♀	5	3	4·0	9·5	14·0	20·5	24·0	38·5	49·0	54·0	—	—	—	—	—	—	—
25	Aug. 13	,,	,,	,,	5	2	4·0	9·0	15·5	21·5	27·0	37·5	51·5	—	—	—	—	—	—	—	—
26	Aug. 13	,,	,,	,,	5	4	5·5	11·5	15·0	18·5	25·0	35·0	38·5	45·0	54·0	—	—	—	—	—	—
27	July 26	,,	,,	,,	4	3	7·5	15·0	20·5	25·0	37·0	44·5	54·5	—	—	—	—	—	—	—	—

[1] Sex determined without opening the fish.

TABLE XXVIIc.—*continued.*

Trout. Locality: Laagen, Lillehammer. Date: June 26—September 3, 1909.

L.-No.	Date.	Length in cm.	Weight in Kgr.	Sex.	Winters Before Altered Growth.	Winters After Altered Growth.	Calculated Length at Formation of Winter-band.														
							1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th	13th	14th	15th
28	Aug. 13	57	2·25	♂	5	2	5·0	10·0	16·5	23·0	29·0	40·0	54·0	—	—	—	—	—	—	—	—
29	July 30	,,	1·85	♀	4	3	6·5	12·5	19·5	27·5	36·0	45·0	54·5	—	—	—	—	—	—	—	—
30	July 30	58	2·15	,,	4	3	7·5	15·5	25·0	29·5	41·0	48·5	56·5	—	—	—	—	—	—	—	—
31	Aug. 9	,,	2·20	,,	5	2	5·0	10·5	20·0	24·5	29·5	40·5	55·0	—	—	—	—	—	—	—	—
32	Aug. 15	59	,,	♂	4	4	4·5	10·0	14·0	21·0	32·0	41·0	48·5	57·0	—	—	—	—	—	—	—
33	July 26	,,	2·30	♀	4	3	6·5	13·5	20·0	25·5	38·0	49·0	57·0	—	—	—	—	—	—	—	—
34	Aug. 12	,,	2·50	,,	5	3	5·5	10·0	15·5	20·0	25·0	34·5	46·0	56·5	—	—	—	—	—	—	—
35	Aug. 15	,,	2·60	,,	5	3	4·0	7·5	11·0	18·0	23·0	34·0	41·0	54·5	—	—	—	—	—	—	—
36	Aug. 4	60	2·15	,,	5	3	3·5	9·5	14·5	20·0	25·0	37·0	48·5	53·5	—	—	—	—	—	—	—
37	Aug. 5	,,	2·45	,,	4	3	4·5	11·0	18·0	22·5	34·0	45·0	58·0	—	—	—	—	—	—	—	—
38	July 30	,,	,,	,,	5	3	5·5	10·0	17·5	21·5	26·0	39·5	49·0	58·5	—	—	—	—	—	—	—
39	Aug. 6	,,	2·50	,,	4	4	6·0	13·0	17·0	21·0	35·0	45·0	52·0	57·5	—	—	—	—	—	—	—
40	Sept. 9	,,	2·55	,,	6	3	5·0	10·0	13·5	17·0	22·0	27·0	38·0	47·5	58·5	—	—	—	—	—	—
41	Aug. 15	,,	2·60	,,	4	3	5·5	13·0	19·0	24·0	35·0	47·0	58·5	—	—	—	—	—	—	—	—
42	July 21	,,	,,	,,	5	3	5·0	10·0	14·0	20·0	27·0	37·5	47·5	58·0	—	—	—	—	—	—	—
43	Aug. 2	61	2·30	,,	4	3	5·5	10·5	18·0	24·0	36·0	46·0	59·5	—	—	—	—	—	—	—	—
44	Aug. 6	,,	2·50	,,	5	3	6·0	12·0	18·0	25·0	32·0	42·0	51·0	60·0	—	—	—	—	—	—	—
45	Aug. 12	,,	,,	,,	6	3	5·0	9·0	13·0	17·5	23·0	29·5	43·0	51·5	60·0	—	—	—	—	—	—
46	July 26	,,	,,	,,	4	4	5·0	12·0	18·0	25·0	33·0	41·0	51·0	59·5	—	—	—	—	—	—	—
47	July 26	,,	,,	,,	4	3	5·0	12·5	19·5	27·0	36·0	48·5	59·0	—	—	—	—	—	—	—	—
48	Aug. 16	,,	2·60	,,	5	3	4·5	10·0	16·0	21·0	27·0	46·0	55·5	59·5	—	—	—	—	—	—	—
49	July 16	,,	,,	,,	4	3	4·0	8·0	15·0	21·0	34·0	44·5	59·5	—	—	—	—	—	—	—	—
50	Aug. 2	,,	,,	,,	5	3	7·0	12·0	16·5	22·0	28·0	37·0	49·0	59·5	—	—	—	—	—	—	—
51	July 11	,,	2·62	,,	4	3	5·5	12·0	19·0	26·0	36·0	48·5	60·0	—	—	—	—	—	—	—	—
52	July 30	,,	2·65	,,	4	4	7·5	15·0	20·5	25·0	32·5	42·5	51·5	60·0	—	—	—	—	—	—	—
53	Aug. 2	,,	,,	,,	6	2	6·0	11·0	15·0	19·5	24·0	30·0	44·0	59·0	—	—	—	—	—	—	—
54	July 26	,,	2·70	,,	4	3	8·5	16·5	21·5	25·0	38·5	48·0	59·0	—	—	—	—	—	—	—	—
55	Aug. 13	62	2·50	♂	4	4	5·0	11·0	18·5	23·5	36·0	48·5	55·0	60·0	—	—	—	—	—	—	—
56	Aug. 13	,,	2·25	♀	4	4	6·0	10·0	13·5	20·5	33·0	45·5	54·0	60·0	—	—	—	—	—	—	—

TABLE XXVIIc.—*continued.*

Trout. Locality: Laagen, Lillehammer. Date: June 26—September 3, 1909.

L.-No.	Date.	Length in cm.	Weight in Kgr.	Sex.	Winters Before Altered Growth.	Winters After Altered Growth.	Calculated Length at Formation of Winter-band.														
							1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th	13th	14th	15th
57	Aug. 13	62	2·50	♀	4	3	6·0	12·0	19·0	25·5	36·0	47·5	59·0	—	—	—	—	—	—	—	—
58	Aug. 9	,,	,,	,,	5	4	5·0	11·5	17·0	24·0	29·5	40·0	50·0	55·0	60·0	—	—	—	—	—	—
59	July 13	,,	2·75	,,	6	3	7·0	12·0	18·0	22·0	28·0	34·0	35·5	52·0	60·0	—	—	—	—	—	—
60	Aug. 5	63	2·60	,,	5	5	6·0	12·0	16·5	20·0	25·0	32·0	38·5	47·5	55·0	61·0	—	—	—	—	—
61	Aug. 2	,,	,,	,,	4	4	7·0	12·5	17·0	21·0	32·5	41·5	52·5	61·5	—	—	—	—	—	—	—
62	Aug. 30	64	2·90	♂	4	3	5·0	12·0	19·5	28·0	44·0	55·0	60·0	—	—	—	—	—	—	—	—
63	Aug. 13	,,	3·00	♀	5	3	4·5	11·0	16·0	21·5	26·0	40·5	53·0	62·0	—	—	—	—	—	—	—
64	Aug. 13	,,	,,	,,	5	3	5·0	12·0	18·0	23·5	31·0	42·0	51·0	62·0	—	—	—	—	—	—	—
65	Aug. 6	,,	,,	,,	4	3	7·0	12·0	17·5	24·0	38·0	51·0	62·0	—	—	—	—	—	—	—	—
66	July 30	,,	,,	,,	5	3	4·5	11·0	16·0	21·0	27·5	38·5	49·0	61·5	—	—	—	—	—	—	—
67	July 15	,,	,,	,,	5	3	3·5	6·5	12·0	17·0	22·0	34·0	51·0	62·0	—	—	—	—	—	—	—
68	Aug. 13	65	2·50	♂	5	3	5·0	10·0	14·5	18·5	24·5	39·0	55·5	62·5	—	—	—	—	—	—	—
69	Aug. 4	,,	3·20	,,	6	3	6·0	10·0	13·5	18·5	23·5	29·5	40·0	50·5	63·0	—	—	—	—	—	—
70	July 21	,,	2·95	♀	4	4	5·0	10·0	16·0	21·5	32·5	43·0	53·5	64·0	—	—	—	—	—	—	—
71	Aug. 3	,,	3·00	,,	5	3	6·0	13·5	19·5	23·5	28·5	42·0	52·0	64·0	—	—	—	—	—	—	—
72	Aug. 5	,,	,,	,,	4	4	5·5	8·0	14·5	19·5	32·5	44·0	55·0	62·5	—	—	—	—	—	—	—
73	Aug. 15	,,	3·20	,,	5	3	7·0	14·5	19·0	23·5	29·0	41·5	51·5	62·0	—	—	—	—	—	—	—
74	Aug. 2	,,	,,	,,	6	3	4·5	9·0	14·5	19·0	23·0	28·0	46·0	54·0	62·5	—	—	—	—	—	—
75	Aug. 28	,,	3·75	,,	4	3	4·5	9·5	17·0	22·5	38·5	51·0	63·0	—	—	—	—	—	—	—	—
76	Aug. 15	66	3·10	♂	6	5	5·0	10·0	13·5	18·0	22·0	25·0	34·0	43·0	53·0	57·5	63·5	—	—	—	—
77	Aug. 15	,,	3·20	,,	4	4	5·0	12·5	18·5	25·0	36·5	46·5	54·0	63·5	—	—	—	—	—	—	—
78	Aug. 12	,,	,,	♀	5	3	6·0	11·0	17·0	21·0	27·5	43·0	51·0	62·5	—	—	—	—	—	—	—
79	July 19	,,	,,	,,	4	4	5·5	10·0	14·0	19·5	30·0	42·5	55·5	64·5	—	—	—	—	—	—	—
80	July 22	,,	3·25	,,	4	4	6·0	13·0	18·0	24·0	36·5	47·0	56·0	65·0	—	—	—	—	—	—	—
81	July 16	,,	3·40	,,	4	3	7·0	14·5	24·0	28·5	44·0	56·5	64·0	—	—	—	—	—	—	—	—
82	Aug. 12	,,	3·50	,,	5	3	7·0	13·5	19·5	24·5	29·0	42·0	52·0	64·0	—	—	—	—	—	—	—
83	July 13	67	3·15	,,	4	4	6·0	12·0	17·0	25·0	37·0	49·0	58·0	65·0	—	—	—	—	—	—	—
84	July 30	,,	3·30	,,	4	4	7·0	16·0	21·5	26·5	36·2	47·0	56·0	65·5	—	—	—	—	—	—	—
85	Aug. 13	,,	3·50	,,	4	4	5·0	12·0	18·5	23·5	36·5	44·5	57·0	65·0	—	—	—	—	—	—	—

TABLE XXVIIc.—*continued.*

Trout. Locality: Laagen, Lillehammer. Date: June 26—September 3, 1909.

L.-No.	Date.	Length in cm.	Weight in Kgr.	Sex.	Winters Before Altered Growth.	Winters After Altered Growth.	Calculated Length at Formation of Winter-band.														
							1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th	13th	14th	15th
86	Aug. 13	67	3·50	♀	5	4	7·0	15·0	20·5	25·0	31·0	37·0	48·5	57·0	65·5	—	—	—	—	—	—
87	July 19	,,	,,	,,	5	4	6·0	11·0	17·0	22·0	25·0	33·5	44·5	54·0	65·0	—	—	—	—	—	—
88	Aug. 30	,,	3·70	,,	5	3	5·0	12·0	16·5	22·0	29·0	43·5	54·0	65·0	—	—	—	—	—	—	—
89	Aug. 13	68	3·50	,,	5	3	2·8	8·5	14·5	23·5	30·0	42·5	55·0	66·0	—	—	—	—	—	—	—
90	Aug. 15	,,	3·70	,,	5	4	5·0	13·0	18·5	24·0	30·0	44·0	53·0	61·0	66·0	—	—	—	—	—	—
91	Aug. 13	,,	4·00	,,	6	3	7·5	14·0	19·0	24·0	28·0	34·0	47·0	54·5	66·0	—	—	—	—	—	—
92	Aug. 13	69	,,	♂	4	4	6·0	12·5	17·5	24·5	39·0	50·0	58·0	66·5	—	—	—	—	—	—	—
93	July 18	,,	4·10	♀	6	4	6·0	12·5	16·5	19·5	24·0	29·5	39·0	49·0	58·0	66·5	—	—	—	—	—
94	Aug. 4	,,	3·60	♂	5	6	6·0	10·0	13·0	16·0	18·5	31·5	40·5	51·0	60·0	65·5	68·0	—	—	—	—
95	July 11	,,	3·67	,,	4	4	7·0	13·5	18·0	23·0	38·5	48·5	58·5	67·5	—	—	—	—	—	—	—
96	Aug. 12	,,	3·75	,,	4	4	7·0	13·5	17·0	22·0	35·0	48·0	57·5	67·0	—	—	—	—	—	—	—
97	July 12	,,	3·85	,,	4	4	6·0	14·0	19·0	24·0	36·0	46·5	60·5	66·5	—	—	—	—	—	—	—
98	Aug. 13	,,	4·00	,,	4	4	6·0	13·0	18·5	25·0	36·0	50·5	59·5	67·5	—	—	—	—	—	—	—
99	Aug. 16	,,	4·35	,,	5	3	6·0	10·5	17·0	22·0	29·0	40·0	55·0	66·5	—	—	—	—	—	—	—
100	July 11	70	3·55	,,	5	3	4·5	15·0	19·5	23·0	30·5	45·5	59·0	68·0	—	—	—	—	—	—	—
101	Aug. 12	,,	3·90	,,	5	4	7·0	12·5	17·0	21·0	24·0	36·5	50·5	59·5	68·0	—	—	—	—	—	—
102	July 15	,,	4·00	,,	5	4	8·0	14·5	21·0	25·5	30·5	41·0	54·0	61·0	69·0	—	—	—	—	—	—
103	July 14	,,	,,	,,	6	3	6·0	11·5	17·0	21·0	25·0	28·0	42·5	55·0	68·0	—	—	—	—	—	—
104	July 28	,,	4·10	,,	5	4	4·0	11·0	16·5	22·0	27·0	38·5	51·5	60·5	69·0	—	—	—	—	—	—
105	Aug. 4	,,	,,	,,	4	4	5·0	13·5	20·5	24·5	37·5	50·0	59·5	68·5	—	—	—	—	—	—	—
106	July 29	,,	4·25	,,	4	4	6·0	11·0	16·0	21·5	37·5	48·0	58·5	68·5	—	—	—	—	—	—	—
107	Aug. 12	,,	4·35	,,	6	3	7·0	14·5	18·5	23·5	27·0	31·0	45·0	54·0	68·0	—	—	—	—	—	—
108	July 14	,,	4·50	,,	4	4	7·0	12·5	17·5	24·5	38·0	52·0	62·5	69·0	—	—	—	—	—	—	—
109	July 19	71	4·00	,,	3	6	6·0	13·0	21·0	34·0	46·5	57·5	64·0	65·5	69·5	—	—	—	—	—	—
110	Aug. 12	,,	,,	,,	5	4	5·0	12·0	17·0	22·0	26·0	40·0	53·0	62·0	69·0	—	—	—	—	—	—
111	July 13	,,	4·15	,,	6	3	6·0	13·5	18·0	22·5	27·5	31·0	45·0	58·0	69·0	—	—	—	—	—	—
112	July 22	,,	4·60	,,	4	4	6·0	13·5	19·5	26·0	38·0	49·5	60·0	69·0	—	—	—	—	—	—	—
113	July 26	72	4·05	,,	5	4	5·0	12·0	17·0	23·0	31·0	44·0	54·0	63·5	70·5	—	—	—	—	—	—
114	July 15	,,	4·50	,,	5	4	4·0	8·3	13·5	18·0	22·5	37·0	50·5	61·5	70·0	—	—	—	—	—	—

TABLE XXVIIc.—*continued.*

Trout. Locality: Laagen, Lillehammer. Date: June 26—September 3, 1909.

L.-No.	Date.	Length in cm.	Weight in Kgr.	Sex.	Winters Before Altered Growth.	Winters After Altered Growth.	Calculated Length at Formation of Winter-band.														
							1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th	13th	14th	15th
115	Aug. 28	72	4·50	♀	5	3	7·0	12·0	17·0	24·5	32·0	48·0	62·0	70·5	—	—	—	—	—	—	—
116	Aug. 3	,,	4·60	,,	5	4	4·0	8·0	15·0	19·5	27·0	39·5	50·0	60·0	70·0	—	—	—	—	—	—
117	Sept. 2	,,	5·00	,,	4	4	5·0	11·0	16·5	24·5	37·5	53·0	62·5	69·5	—	—	—	—	—	—	—
118	Aug. 2	73	4·70	,,	5	4	5·5	12·0	17·5	24·0	28·0	39·5	53·0	63·0	71·0	—	—	—	—	—	—
119	July 18	,,	4·95	,,	4	4	6·5	13·5	20·0	28·0	43·0	54·0	63·5	71·5	—	—	—	—	—	—	—
120	Aug. 12	,,	5·25	,,	5	4	5·0	10·5	17·5	22·0	29·0	39·0	52·5	61·5	71·5	—	—	—	—	—	—
121	Aug. 15	74	3·90	♂	5	4	6·0	12·0	17·0	23·0	26·0	41·5	55·5	64·5	71·2	—	—	—	—	—	—
122	July 22	,,	4·00	,,	4	5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
123	Aug. 30	,,	4·40	♀	5	4	6·0	10·0	16·0	21·5	26·5	41·0	54·0	63·5	72·5	—	—	—	—	—	—
124	Aug. 28	,,	5·70	,,	5	4	6·5	13·0	18·0	22·5	30·5	42·0	54·5	65·5	72·0	—	—	—	—	—	—
125	July 18	75	4·55	♂	6	4	5·0	9·5	12·0	18·0	27·0	34·0	43·5	53·0	63·0	73·5	—	—	—	—	—
126	Aug. 3	,,	4·90	♀	4	4	6·0	11·0	16·0	23·5	37·5	49·0	63·0	73·0	—	—	—	—	—	—	—
127	Aug. 15	,,	5·75	,,	5	4	8·0	14·0	19·5	23·0	28·0	42·0	57·0	67·5	73·5	—	—	—	—	—	—
128	Aug. 13	76	5·00	♂	4	4	6·0	13·0	18·0	23·0	40·0	54·0	65·0	74·5	—	—	—	—	—	—	—
129	Aug. 15	,,	5·90	,,	5	4	5·0	10·0	14·5	18·5	23·5	42·0	56·0	64·5	73·5	—	—	—	—	—	—
130	July 8	,,	4·75	♀	4	4	5·0	12·5	19·5	25·0	42·0	51·0	66·5	74·0	—	—	—	—	—	—	—
131	Aug. 30	,,	5·75	,,	5	5	4·5	12·0	18·5	25·0	29·0	38·0	51·0	61·5	68·5	73·0	—	—	—	—	—
132	July 30	77	4·90	♂	3	7	6·5	14·0	18·0	28·0	38·0	50·5	62·0	71·0	72·0	75·5	—	—	—	—	—
133	Aug. 15	,,	6·05	,,	4	4	5·0	10·0	16·5	25·0	39·0	56·0	67·0	75·0	—	—	—	—	—	—	—
134	Aug. 2	,,	5·45	♀	5	4	6·0	13·0	17·0	24·0	32·0	44·0	57·5	63·0	74·5	—	—	—	—	—	—
135	June 25	,,	5·50	,,	4	5	6·0	9·5	16·5	23·0	32·0	44·0	56·5	65·5	75·5	—	—	—	—	—	—
136	Aug. 4	78	5·20	♂	5	5	4·0	9·0	16·0	23·0	29·5	45·5	59·0	64·5	70·5	76·0	—	—	—	—	—
137	Aug. 13	,,	6·00	,,	5	4	7·0	13·0	18·0	25·0	32·0	44·0	58·0	66·0	75·5	—	—	—	—	—	—
138	Aug. 10	,,	7·00	,,	5	5	6·0	13·0	18·0	23·5	28·0	40·0	50·0	61·0	68·0	75·5	—	—	—	—	—
139	Aug. 10	,,	6·10	♀	4	4	8·0	14·0	19·0	27·0	38·5	54·0	66·0	76·0	—	—	—	—	—	—	—
140	Aug. 6	79	5·00	♂	5	5	5·0	11·5	17·0	23·5	26·5	37·0	50·0	63·5	70·0	76·0	—	—	—	—	—
141	Sept. 2	,,	6·30	,,	4	5	6·5	16·0	21·0	25·0	37·0	50·0	60·0	69·5	76·5	—	—	—	—	—	—
142	Aug. 28	,,	5·30	♀	5	4	5·5	11·0	18·5	22·5	26·5	40·0	53·0	67·0	73·5	—	—	—	—	—	—
143	Aug. 2	,,	5·80	,,	5	6	7·0	13·0	17·0	21·5	25·5	39·5	47·0	59·5	68·0	73·5	77·5	—	—	—	—

TABLE XXVIIc,—*continued.*

Trout. Locality: Laagen, Lillehammer. Date: June 26—September 3, 1909.

L.-No.	Date.	Length in cm.	Weight in Kgr.	Sex.	Winters Before Altered Growth.	Winters After Altered Growth.	Calculated Length at Formation of Winter-band.														
							1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th	13th	14th	15th
144	Aug. 2	81	6·00	♀	5	6	5·0	7·5	10·5	15·5	21·5	34·0	46·5	60·0	65·2	72·0	79·0	—	—	—	—
145	Sept. 2	,,	7·45	,,	5	5	5·0	11·0	18·5	23·5	31·0	44·0	58·0	68·0	75·0	79·0	—	—	—	—	—
146	Aug. 28	82	7·30	♂	5	4	7·0	12·0	20·5	26·0	33·5	45·0	54·5	68·5	77·0	—	—	—	—	—	—
147	Aug. 9	,,	7·35	,,	5	4	8·0	15·0	21·5	29·5	37·5	54·5	68·0	75·0	80·0	—	—	—	—	—	—
148	Aug. 15	83	7·10	♀	5	4	8·0	16·5	22·0	27·0	35·5	51·0	64·0	74·0	80·0	—	—	—	—	—	—
149	Aug. 9	,,	7·20	,,	6	4	8·0	13·5	18·0	23·0	27·5	32·0	44·5	63·0	73·5	81·0	—	—	—	—	—
150	Sept. 2	84	6·80	♂	4	5	7·0	15·0	23·0	30·0	45·5	58·5	72·5	80·0	82·5	—	—	—	—	—	—
151	July 26	,,	,,	♀	5	6	5·5	12·5	19·5	23·0	28·0	40·0	52·0	63·0	71·5	76·0	81·0	—	—	—	—
152	Aug. 9	85	5·75	♂	5	5	8·0	13·0	21·0	28·0	33·5	53·0	65·5	73·0	79·5	83·0	—	—	—	—	—
153	Aug. 16	,,	8·30	♀	4	6	6·0	14·0	22·0	26·0	37·0	46·0	57·0	69·0	76·5	83·0	—	—	—	—	—
154	July 2	86	8·15	♂	4	6	6·5	13·0	19·5	25·5	36·0	49·5	64·5	75·0	81·0	85·0	—	—	—	—	—
155	Aug. 21	,,	9·55	,,	5	6	6·5	11·5	15·5	18·5	25·0	40·0	53·0	66·0	73·5	79·0	84·5	—	—	—	—
156	Aug. 6	,,	6·15	♀	5	6	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
157	Aug. 19	,,	9·25	,,	4	5	6·0	12·5	19·5	24·0	34·5	48·5	65·5	77·5	83·0	—	—	—	—	—	—
158	Aug. 19	87	7·80	♂	5	6	5·5	11·5	18·0	24·0	29·0	41·5	53·0	65·0	75·0	81·0	86·0	—	—	—	—
159	Aug. 5	,,	8·55	♀	4	6	6·0	13·0	21·0	27·0	38·0	49·5	65·0	75·5	81·5	86·0	—	—	—	—	—
160	Aug. 5	,,	10·15	,,	5	6	5·0	10·0	17·0	21·0	27·0	40·0	52·5	66·0	74·5	79·0	85·0	—	—	—	—
161	July 23	88	7·60	♂	5	5	5·5	10·0	16·5	23·0	28·0	42·0	57·0	73·0	82·0	86·0	—	—	—	—	—
162	July 20	89	8·00	♀	3	6	5·5	12·0	20·5	38·0	51·5	67·0	78·5	84·0	87·5	—	—	—	—	—	—
163	Sept. 2	90	7·15	♂	5	8	7·0	17·0	23·0	27·5	34·0	44·5	54·5	69·0	75·0	79·5	83·5	87·5	89·0	—	—
164	July 21	,,	7·50	,,	5	9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
165	Aug. 13	,,	8·50	,,	4	8	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
166	Aug. 21	,,	10·50	,,	5	7	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
167	Aug. 4	91	9·00	,,	6	7	4·5	8·0	13·5	16·0	19·0	24·0	41·5	53·5	66·5	78·0	83·5	88·0	89·5	—	—
168	Sept. 3	92	,,	,,	5	8	5·5	12·0	17·0	21·5	26·0	40·0	46·0	57·0	67·0	77·0	84·0	88·5	91·0	—	—
169	Sept. 3	,,	9·25	,,	4	8	7·0	14·5	20·0	26·5	46·0	62·0	76·0	81·0	84·5	87·0	89·0	91·0	—	—	—
170	Sept. 3	94	9·65	,,	5	7	6·0	13·0	21·0	27·0	33·0	48·5	64·0	77·5	81·5	86·0	89·5	92·0	—	—	—
171	Aug. 16	96	11·70	,,	5	8	6·5	14·0	19·5	24·0	32·0	50·0	60·5	71·5	86·0	89·5	92·0	93·5	95·0	—	—
172	Sept. 3	98	11·15	,,	5	8	4·5	9·0	16·0	23·0	30·5	46·0	64·0	72·0	80·5	87·0	92·0	96·0	97·5	—	—
173	Sept. 2	99	11·60	,,	4	11	4·5	12·5	17·5	23·5	37·5	47·5	56·0	67·5	75·5	82·5	87·0	91·0	93·9	96·0	98·0

TABLE XXVIII.

Trout.[1] Locality: Laagen, between Langesjøen and Hølen (Numedal).
Date: August 26—27, 1909.

L.-No.	Length in cm.	Weight.	Sex.	Age in Winters.	Calculated length at formation of Winter-band.							
					1st	2nd	3rd	4th	5th	6th	7th	8th
1	19	—	♀	4	3·5	7·6	11·6	15·8	—	—	—	—
2	20	—	♂	4	3·4	8·3	12·6	16·6	—	—	—	—
3	24	—	,,	5	4·2	7·8	13·4	17·5	21·0	—	—	—
4	26	—	♀	6	4·3	7·4	11·0	14·9	19·5	23·5	—	—
5	28	—	,,	6	4·9	8·8	12·4	17·5	22·2	24·3	—	—
6	29	—	,,	7	4·7	8·8	11·2	15·7	19·0	20·7	27·0	—
7	34	—	,,	8	5·0	10·6	13·8	17·8	21·0	24·4	26·4	30·5
Average length in cm. . . .					4·3	8·5	12·3	16·5	20·5	23·3	26·7	30·5

TABLE XXIX.

Trout.[1] Locality: Laagen below Hølen (Numedal.) Date: August 23, 1909.

L.-No.	Length in cm.	Weight.	Sex.	Age in Winters.	Calculated length at formation of Winter-band.							
					1st	2nd	3rd	4th	5th	6th	7th	8th
1	21	—	♀	5	4·2	7·9	12·8	15·3	17·6	—	—	—
2	23	—	♂	5	3·4	7·3	12·0	15·4	19·4	—	—	—
3	25	—	,,	5	4·3	9·0	14·8	18·1	21·4	—	—	—
4	26	—	,,	5	5·9	10·9	17·5	20·4	24·0	—	—	—
5	,,	—	♀	5	4·7	10·6	15·4	19·7	23·4	—	—	—
6	28	—	♂	5	5·8	10·0	16·2	19·5	23·7	—	—	—
7	29	—	♀	6	4·7	9·0	12·9	17·6	20·4	25·9	—	—
8	30	—	♂	8	5·6	9·8	12·0	15·4	19·3	20·4	25·4	28·3
Average length in cm. . . .					4·8	9·3	14·2	17·8	21·2	23·2	25·4	28·3

[1] Taken with worm and fly.

TABLE XXX.

Trout.[1] Locality: Hølen (Numedal). Date: August 24—28, 1909.

L.-No.	Length in cm.	Weight in gr.	Sex.	Age in winters.	Calculated Length at Formation of Winter-band.													
					1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th	13th	14th
1	24	225	♂	5	5·0	8·5	13·9	18·7	21·2	—	—	—	—	—	—	—	—	—
2	28	,,	♀	7	3·8	7·9	11·5	15·2	20·8	23·9	26·1	—	—	—	—	—	—	—
3	32	300	♂	8	5·9	9·9	13·2	15·8	20·5	23·6	26·3	29·4	—	—	—	—	—	—
4	,,	,,	♀	8	5·9	10·0	12·4	16·0	19·1	22·0	25·4	28·3	—	—	—	—	—	—
5	,,	350	,,	8	6·6	10·1	12·6	16·2	19·9	23·1	25·5	28·2	—	—	—	—	—	—
6	33	,,	♂	8	4·9	8·3	11·4	15·0	19·1	24·4	27·4	30·6	—	—	—	—	—	—
7	,,	400	,,	8	5·4	9·4	12·0	15·5	19·5	23·8	27·3	30·5	—	—	—	—	—	—
8	,,	,,	,,	9	4·9	7·4	11·3	13·4	17·3	20·3	24·0	27·4	30·1	—	—	—	—	—
9	34	350	,,	8	4·7	8·5	12·0	15·1	20·1	24·3	27·9	31·5	—	—	—	—	—	—
10	,,	450	♀	8	4·7	8·2	11·4	14·7	18·4	22·7	25·7	30·0	—	—	—	—	—	—
11	35	350	,,	8	6·0	10·9	13·5	17·1	19·6	23·0	26·4	30·7	—	—	—	—	—	—
12	,,	400	♂	8	5·6	10·3	12·9	16·5	20·9	26·0	29·1	31·8	—	—	—	—	—	—
13	36	425	,,	8	6·2	8·0	12·1	16·2	20·6	25·4	30·8	33·8	—	—	—	—	—	—
14	,,	550	,,	10	5·6	10·1	15·3	18·9	21·5	24·9	28·2	30·7	32·8	34·8	—	—	—	—
15	37	475	♀	9	5·0	10·8	14·3	16·8	19·7	23·5	27·9	31·1	34·2	—	—	—	—	—
16	38	500	♂	9	5·2	9·7	14·3	16·8	20·7	26·4	29·4	32·4	35·4	—	—	—	—	—
17	39	600	,,	9	6·0	9·8	13·8	16·8	19·9	23·9	28·1	31·2	34·3	—	—	—	—	—
18	,,	550	♀	10	5·8	10·0	14·2	17·6	20·9	23·5	27·2	30·7	34·0	36·7	—	—	—	—
19	42	750	♂	9	4·7	9·5	13·6	17·6	21·6	26·2	29·9	34·2	38·8	—	—	—	—	—
20	49	1,500	,,	14	4·2	7·2	9·9	14·0	19·2	23·9	27·3	29·7	32·6	35·6	39·3	42·3	46·2	47·9
Average length in cm. .					5·3	9·2	12·8	16·2	20·0	23·9	27·3	30·7	34·0	35·7	39·3	42·3	46·2	47·9

[1] Taken with worm, spinning bait, and fly.

TABLE XXXI.

Trout.[1] Locality: Djupe (Numedal). Date: August 24, 1909.

L.-No.	Length in cm.	Weight in gr.	Sex.	State of Sex Org.	Age in Winters.	Calculated Length at Formation of Winter-band.									
						1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
1	24	—	♂	—	5	6·7	11·9	14·8	18·7	21·6	—	—	—	—	—
2	26	—	♀	4	7	5·2	7·8	11·3	16·0	18·5	21·2	23·9	—	—	—
3	30	—	♂	—	6	5·0	10·7	15·6	18·2	22·0	27·5	—	—	—	—
4	,,	—	,,	—	7	7·9	13·5	16·7	19·7	24·2	26·3	28·2	—	—	—
5	37	—	♀	5	8	3·6	8·7	13·6	21·7	26·4	29·4	32·0	35·7	—	—
6	38	—	♂	4	8	4·8	8·3	11·4	17·2	21·3	26·8	32·4	35·7	—	—
7	,,	400	♀	4	8	4·2	8·8	13·6	17·9	22·7	27·2	31·7	36·7	—	—
8	40	—	,,	5	10?	5·8	11·6	17·7	20·3	25·5	28·8	31·2	34·6	36·7	38·4
9	42	620	,,	4	10	5·5	9·6	14·3	17·8	21·1	30·2	34·2	36·3	39·5	41·0
Average length in cm.						5·4	10·1	14·3	18·6	22·6	27·2	30·5	35·8	38·1	39·7

[1] Taken with fly.

TABLE XXXII.

Trout.[1] Locality: Ossjøen. Dagalid (Numedal). Date: September 7—8, 1909.

L.-No.	Length in cm.	Weight in gr.	Sex.	Age in Winters.	Calculated Length at Formation of Winter-band.											
					1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th
1	51	1200	♀	9	7·4	11·4	14·8	19·0	24·7	31·5	38·7	44·2	49·0	—	—	—
2	53	1380	♀	9	7·0	11·2	15·5	21·9	27·6	31·6	38·0	44·7	50·2	—	—	—
3	54	1700	♀	9	5·3	11·0	15·4	18·8	24·0	31·5	37·7	44·3	50·3	—	—	—
4	60	2000	,,	12	8·5	11·2	17·3	22·2	26·2	31·0	36·0	42·4	47·7	53·0	57·0	59·0
5	62	2130	♂	10	9·0	12·5	16·8	21·3	28·2	36·3	41·5	49·5	56·5	60·0	—	—
6	63	2570	,,	12	7·0	11·0	16·5	22·0	27·5	35·5	40·0	48·5	53·7	57·0	59·0	61·4
Average length in cm.					7·4	11·4	16·1	20·9	26·3	32·9	38·7	45·6	51·2	56·7	58·0	60·2

[1] Taken with spinner and fly.

TABLE XXXIII.

Trout.[1] Locality: Krokaa, Skilbotten, Brønnøy. Date, July 21, 1907.

Birth-year.		1905			1904			1903			1902			1901		
Length, in cm.	Number of fish examined.	2 winters.			3 winters.			4 winters.			5 winters.			6 winters.		
		♂	♀	Tot.	♂	♀	Tot.	♂	♀	Tot.	♂	♂	Tot.	♂	♀	Tot.
12	1	1	—	1	—	—	—	—	—	—	—	—	—	—	—	—
13	2	1	—	1	1	—	1	—	—	—	—	—	—	—	—	—
14	2	—	—	—	—	2	2	—	—	—	—	—	—	—	—	—
15	3	—	—	—	—	2	2	—	1	1	—	—	—	—	—	—
16	6	—	—	—	1	—	1	3	2	5	—	—	—	—	—	—
17	14	—	—	—	—	—	—	5	3	8	2	4	6	—	—	—
18	20	—	—	—	—	—	—	4	3	7	6	7	13	—	—	—
19	8	—	—	—	—	—	—	—	1	1	4	2	6	—	1	1
20	13	—	—	—	—	—	—	1	—	1	7	3	10	1	1	2
21	4	—	—	—	—	—	—	—	—	—	2	2	4	—	—	—
22	5	—	—	—	—	—	—	—	—	—	2	—	2	3	—	3
73	1	—	—	—	—	—	—	—	—	—	—	—	—	1	—	1
24	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	79	2	—	2	2	4	6	13	10	23	23	18	41	5	2	7
Average length in cm.		12·5			14·5			17·2			18·0			21·0		

[1] Taken with fly.

TABLE XXXIIIB.

Trout.[1] Locality: Krokaa, Skilbotten, Brønnøy. Date, August 8, 1907.

Birth-year.		1905			1904			1903			1902			1901		
Length. in cm.	Number of fish examined.	2 winters.			3 winters.			4 winters.			5 winters.			6 winters.		
		♂	♀	Tot.	♂	♀	Tot.	♂	♀	Tot.	♂	♀	Tot.	♂	♂	Tot.
11	1	—	1	1	—	—	—	—	—	—	—	—	—	—	—	—
12	1	—	1	1	—	—	—	—	—	—	—	—	—	—	—	—
13	3	—	—	—	1	2	3	—	—	—	—	—	—	—	—	—
14	3	1	—	1	2	—	2	—	—	—	—	—	—	—	—	—
15	2	—	—	—	—	1	1	—	1	1	—	—	—	—	—	—
16	3	—	—	—	—	1	1	1	1	2	—	—	—	—	—	—
17	6	—	—	—	—	—	—	—	4	4	1	1	2	—	—	—
18	3	—	—	—	—	—	—	1	1	2	—	1	1	—	—	—
19	1	—	—	—	—	—	—	—	1	1	—	—	—	—	—	—
10	3	—	—	—	—	—	—	—	—	—	1	—	1	2	—	2
21	4	—	—	—	—	—	—	1	—	1	2	1	3	—	—	—
22	1	—	—	—	—	—	—	—	—	—	—	—	—	1	—	1
23	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	31	1	2	3	3	4	7	3	8	11	4	3	7	3	—	3
Average length in cm.		12·3			14·0			17·2			19·3			20·7		

[1] Taken with fly.

TABLE XXXIV.

Trout.[1] Locality: Sannavand near Harstad. Date: August 3, 1909.

Length in cm.	Number of fish examined.	Birth-year.	1908			1907			1906			1905			1904			1903			1902			1901			1900			1899			1898		
			1 winter.			2 winters.			3 winters.			4 winters.			5 winters.			6 winters.			7 winters.			8 winters.			9 winters.			10 winters.			11 winters.		
			♂	♀	Tot.	♂	♀	Tot.	♂	♀	Tot.	♂	♀	Tot.	♂	♀	Tot.	♂	♀	Tot.	♂	♀	Tot.	♂	♀	Tot.	♂	♀	Tot.	♂	♀	Tot.	♂	♀	Tot.
13	3		2	1	3																														
14	4		2	1	3	1	—	1																											
15	1					1		1																											
16	2		1	—	1	—	1	1																											
17	1					1	—	1																											
18	—																																		
19	1									1	1																								
20	5								2	1	3	1	1	2																					
21	3									1	1		2	2																					
22	4								2		2	1	—	1	1	—	1																		
23	5											2	1	3		2	2																		
24	5											2	1	3	1	1	2																		
25	4											1	1	2	2	—	2																		
26	7											2	1	3	3	1	4																		
27	12											4	2	6	4	1	5	1	—	1															
28	8											2	—	2	3	2	5	—	1	1															
29	3														1	2	3																		
30	4														—	3	3	1	—	1															
31	10														3	2	5	5	—	5															
32	7														2	1	3	1	3	4															
33	7														2	1	3	2	2	4															
34	8														—	1	1	1	3	4	2	1	3												
35	1																				1	—	1												
36	2																	1	—	1	1	—	1												
37	1																	—	1	1															
38	—																																		
39	1																							1	—	1									
40	—																																		
41	—																																		
42	1																							—	1	1									
43	—																																		
44	1																										—	1	1						
45	—																																		
46	1																										1	—	1						
47	1																										—	1	1						
48	1																										1	—	1						
49	1																																1	—	1
Tot	115		5	2	7	3	1	4	4	3	7	15	9	24	22	17	39	12	10	22	4	1	5	1	1	2	2	1	3	—	1	1	1	—	1
Average in cm.			13·9			15·5			20·6			24·6			28·4			32·2			34·6			40·5			46			47			49		

[1] Taken with fly, spinner, long line.

TABLE XXXIVB.

Trout. Locality: Sannavand near Harstad. Date: August 3, 1909.

L.No.	Length in cm.	Weight in gr.	Sex.	State of Sex Org.	Age in Winters.	Calculated Length at Formation of Winter-band.										
						1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th
1	13	20	♂	—	1	7·7	—	—	—	—	—	—	—	—	—	—
2	,,	,,	,,	—	1	6·0	—	—	—	—	—	—	—	—	—	—
3	,,	,,	♀	—	1	7·5	—	—	—	—	—	—	—	—	—	—
4	14	25	♂	—	1	8·0	—	—	—	—	—	—	—	—	—	—
5	,,	,,	,,	—	1	8·0	—	—	—	—	—	—	—	—	—	—
6	,,	,,	,,	—	2	6·6	10·4	—	—	—	—	—	—	—	—	—
7	,,	22	♀	—	1	6·3	—	—	—	—	—	—	—	—	—	—
8	15	30	♂	—	2	4·4	9·4	—	—	—	—	—	—	—	—	—
9	16	40	,,	—	1	10·5	—	—	—	—	—	—	—	—	—	—
10	,,	35	♀	—	2	5·0	13·6	—	—	—	—	—	—	—	—	—
11	17	40	♂	—	2	7·3	15·0	—	—	—	—	—	—	—	—	—
12	19	50	♀	—	3	7·1	10·2	14·8	—	—	—	—	—	—	—	—
13	20	70	♂	—	3	3·8	7·9	12·0	—	—	—	—	—	—	—	—
14	,,	75	,,	—	3	3·4	7·0	12·9	—	—	—	—	—	—	—	—
15	,,	80	,,	—	3	7·4	10·7	17·8	—	—	—	—	—	—	—	—
16	,,	65	♀	—	3	6·6	10·6	17·0	—	—	—	—	—	—	—	—
17	,,	70	,,	—	4	5·9	9·6	13·5	18·2	—	—	—	—	—	—	—
18	21	85	,,	—	4	3·6	10·8	12·9	15·6	—	—	—	—	—	—	—
19	,,	90	,,	—	3	5·0	10·6	17·2	—	—	—	—	—	—	—	—
20	,,	95	,,	—	4	2·5	7·4	11·9	18·0	—	—	—	—	—	—	—
21	22	90	♂	—	5	3·0	6·5	9·6	15·0	19·5	—	—	—	—	—	—
22	,,	,,	,,	—	3	6·4	10·6	17·0	—	—	—	—	—	—	—	—
23	,,	100	,,	—	3	4·0	9·6	13·5	—	—	—	—	—	—	—	—
24	,,	,,	,,	—	4	6·6	9·5	12·3	18·2	—	—	—	—	—	—	—
25	23	110	,,	—	4	5·7	8·5	12·8	20·1	—	—	—	—	—	—	—
26	,,	115	,,	—	4	3·0	7·0	10·3	19·8	—	—	—	—	—	—	—
27	,,	110	♀	—	5	3·7	7·5	10·2	13·7	20·1	—	—	—	—	—	—
28	,,	,,	,,	—	5	3·8	6·7	9·5	12·5	19·7	—	—	—	—	—	—
29	,,	,,	,,	—	4	6·1	9·4	12·7	17·3	—	—	—	—	—	—	—
30	24	,,	♂	—	4	4·3	10·0	14·0	21·3	—	—	—	—	—	—	—
31	,,	120	,,	—	4	4·4	7·5	12·8	20·7	—	—	—	—	—	—	—
32	,,	130	,,	—	5	3·0	7·0	11·4	14·4	21·0	—	—	—	—	—	—
33	,,	115	♀	—	4	3·1	5·8	10·5	21·0	—	—	—	—	—	—	—
34	,,	135	,,	—	5	3·3	7·0	11·1	15·0	20·0	—	—	—	—	—	—
35	25	150	♂	—	4	4·9	7·5	13·0	22·5	—	—	—	—	—	—	—
36	,,	,,	,,	—	5	3·5	5·4	8·1	12·8	22·4	—	—	—	—	—	—
37	,,	155	,,	—	5	3·7	8·3	11·0	15·0	23·0	—	—	—	—	—	—
38	,,	150	♀	—	4	5·4	9·4	13·4	20·4	—	—	—	—	—	—	—
39	26	160	♂	—	4	7·2	10·5	12·7	23·4	—	—	—	—	—	—	—
40	,,	165	,,	—	5	3·0	6·8	10·8	13·6	23·0	—	—	—	—	—	—
41	,,	170	,,	—	4	4·1	8·5	14·6	24·2	—	—	—	—	—	—	—
42	,,	180	,,	—	5	3·6	5·9	8·7	15·2	23·7	—	—	—	—	—	—
43	,,	,,	,,	—	5	3·3	8·0	11·0	14·5	23·2	—	—	—	—	—	—
44	,,	150	♀	—	5	3·9	9·6	13·2	17·2	23·7	—	—	—	—	—	—
45	,,	170	,,	—	4	2·7	7·0	13·0	22·6	—	—	—	—	—	—	—

TABLE XXXIVB.—*continued.*

Trout. Locality: Sannavand near Harstad. Date: August 3, 1909.

L.-No.	Length in cm.	Weight in gr.	Sex.	State of Sex Org.	Age in Winters.	Calculated Length at Formation of Winter-band.										
						1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th
46	27	175	♂	—	5	4·0	7·0	10·8	14·4	24·3	—	—	—	—	—	—
47	,,	,,	,,	—	6	2·5	7·2	10·0	11·8	15·7	24·5	—	—	—	—	—
48	,,	180	,,	—	5	6·7	10·7	12·3	15·2	24·8	—	—	—	—	—	—
49	,,	,,	,,	—	4	7·0	9·3	12·9	24·8	—	—	—	—	—	—	—
50	,,	185	,,	—	4	5·1	8·5	14·2	24·5	—	—	—	—	—	—	—
51	,,	200	,,	—	5	5·8	9·0	11·9	14·9	23·4	—	—	—	—	—	—
52	,,	205	,,	—	5	3·8	9·1	12·6	16·7	25·5	—	—	—	—	—	—
53	,,	215	,,	—	4	3·8	9·5	16·5	23·9	—	—	—	—	—	—	—
54	,,	,,	,,	—	4	5·8	10·6	15·5	24·8	—	—	—	—	—	—	—
55	,,	160	♀	—	4	6·7	10·1	14·4	24·7	—	—	—	—	—	—	—
56	,,	180	,,	—	4	5·5	9·8	17·2	24·7	—	—	—	—	—	—	—
57	,,	210	,,	—	5	3·6	8·7	13·2	19·2	25·4	—	—	—	—	—	—
58	28	190	♂	—	5	3·0	7·0	10·2	14·3	25·9	—	—	—	—	—	—
59	,,	200	,,	—	5	3·6	8·2	11·0	14·5	25·3	—	—	—	—	—	—
60	,,	210	,,	—	5	3·8	8·0	13·1	16·8	25·7	—	—	—	—	—	—
61	,,	,,	,,	—	4	7·4	11·8	17·3	26·1	—	—	—	—	—	—	—
62	,,	215	,,	—	4	5·4	8·6	15·8	24·9	—	—	—	—	—	—	—
63	,,	190	♀	—	5	3·0	7·2	9·9	15·1	26·0	—	—	—	—	—	—
64	,,	200	,,	—	5	2·5	6·1	11·7	16·7	24·9	—	—	—	—	—	—
65	,,	220	,,	—	6	2·5	6·9	10·6	13·7	18·3	26·5	—	—	—	—	—
66	29	245	♂	—	5	3·1	7·2	11·1	17·7	27·0	—	—	—	—	—	—
67	,,	240	♀	—	5	5·3	11·9	17·7	20·1	27·2	—	—	—	—	—	—
68	,,	,,	,,	—	5	4·6	8·1	10·2	16·3	26·8	—	—	—	—	—	—
69	30	265	♂	—	6	3·0	7·0	9·6	13·1	21·3	27·4	—	—	—	—	—
70	,,	245	♀	—	5	8·0	12·2	15·3	20·0	28·3	—	—	—	—	—	—
71	,,	250	,,	—	5	4·4	8·7	12·2	20·5	28·0	—	—	—	—	—	—
72	,,	280	,,	2♀	5	4·3	9·5	14·5	19·2	26·4	—	—	—	—	—	—
73	31	260	♂	2	6	3·9	7·3	12·1	18·2	20·6	29·2	—	—	—	—	—
74	,,	275	,,	2	6	3·1	6·6	10·5	14·6	22·2	28·5	—	—	—	—	—
75	,,	285	,,	2	5	4·5	11·0	16·2	20·4	28·8	—	—	—	—	—	—
76	,,	290	,,	—	5	4·1	8·5	11·5	15·9	26·9	—	—	—	—	—	—
77	,,	,,	,,	—	5	5·7	12·0	14·5	17·9	24·0	—	—	—	—	—	—
78	,,	,,	,,	—	6	5·0	8·6	10·2	13·8	20·7	29·0	—	—	—	—	—
79	,,	310	,,	2	6	6·1	8·0	10·7	13·4	20·2	28·8	—	—	—	—	—
80	,,	320	,,	—	6	5·4	10·0	17·0	21·0	26·7	29·6	—	—	—	—	—
81	,,	265	♀	—	5	3·7	10·8	13·8	17·8	27·7	—	—	—	—	—	—
82	,,	285	,,	—	5	4·8	10·1	13·5	18·4	26·5	—	—	—	—	—	—
83	32	290	♂	—	5	5·4	12·0	18·9	25·7	20·8	—	—	—	—	—	—
84	,,	,,	,,	2♀	6	6·8	9·3	13·7	17·0	24·9	30·5	—	—	—	—	—
85	,,	315	,,	—	5	7·0	10·8	13·2	21·0	29·2	—	—	—	—	—	—
86	,,	310	♀	—	5	7·5	13·5	19·0	26·3	30·3	—	—	—	—	—	—
87	,,	320	,,	—	6	4·0	8·5	14·5	18·5	20·7	30·6	—	—	—	—	—
88	,,	,,	,,	—	6	5·5	8·0	10·5	13·5	15·5	25·9	—	—	—	—	—
89	,,	380	,,	—	6	4·7	9·3	13·6	16·3	24·0	30·0	—	—	—	—	—
90	33	320	♂	2	6	7·5	11·8	16·2	20·2	27·8	30·9	—	—	—	—	—

TABLE XXXIVB.—*continued.*

Trout. Locality: Sannavand near Harstad. Date: August 3, 1909.

L.-No.	Length in cm.	Weight in gr.	Sex.	State of Sex Org.	Age in Winters.	Calculated Length at Formation of Winter-band.										
						1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th
91	33	325	♂	—	6	3·5	8·0	11·7	20·0	26·7	31·5	—	—	—	—	—
92	,,	330	,,	2	5	3·9	9·2	16·7	20·0	28·0	—	—	—	—	—	—
93	,,	400	,,	—	5	4·3	9·8	13·8	21·0	30·1	—	—	—	—	—	—
94	,,	315	♀	—	6	3·3	6·5	10·0	15·3	25·7	30·1	—	—	—	—	—
95	,,	350	,,	1—2	6	2·8	7·7	10·8	15·8	24·4	31·6	—	—	—	—	—
96	,,	390	,,	3	5?	3·4	6·6	10·2	17·5	27·5	—	?	—	—	—	—
97	34	340	♂	2?	7	6·2	9·7	12·3	15·9	19·4	28·6	32·5	—	—	—	—
98	,,	350	,,	—	7	3·0	8·2	10·8	14·5	19·4	26·9	31·6	—	—	—	—
99	,,	430	,,	2	6	4·2	7·8	12·8	20·0	26·5	31·6	—	—	—	—	—
100	,,	350	♀	3	7	6·1	9·6	11·7	14·9	19·9	27·5	32·5	—	—	—	—
101	,,	390	,,	2?	6	3·3	7·7	9·9	18·5	27·5	32·8	—	—	—	—	—
102	,,	400	,,	—	6	4·5	8·0	10·3	16·1	24·7	32·0	—	—	—	—	—
103	,,	,,	,,	2	5	6·5	10·7	13·8	20·0	30·5	—	—	—	—	—	—
104	,,	,,	,,	3	6	4·3	8·2	11·1	17·0	19·9	29·8	—	—	—	—	—
105	35	450	♂	2?	7	3·5	7·2	10·6	16·0	20·0	29·3	30·2	—	—	—	—
106	36	470	,,	,,	6	6·5	10·4	15·9	20·2	25·7	31·8	—	—	—	—	—
107	,,	500	♀	2	7	3·0	6·3	10·8	16·2	25·1	31·0	34·6	—	—	—	—
108	37	450	,,	—	6	3·7	6·6	11·3	19·6	28·8	34·2	—	—	—	—	—
109	39	650	♂	—	8	3·0	6·3	10·3	16·8	25·0	30·5	35·0	37·7	—	—	—
110	42	700	♀	2(7)	8?	5·2	8·7	12·7	20·0	25·8	32·0	40·1	41·1?	—	—	—
111	44	800	,,	3—4	9	5·4	11·0	15·4	20·1	25·5	34·3	39·2	41·7	42·9	—	—
112	46	,,	♂	2	9	5·1	9·4	16·6	20·4	24·0	34·5	37·9	42·9	44·5	—	—
113	47	950	♀	2(7)	10?	7·2	12·0	17·8	23·0	28·3	35·5	42·2	43·8	45·3?	46·4?	—
114	48	900	♂	2	9	4·4	13·0	20·7	26·4	31·8	37·6	41·7	45·2	47·1	—	—
115	49	,,	,,	,,	11—12	7·2	10·6	15·6	18·7	28·3	32·5	36·9	39·8	42·1	45·5	48·2?
Average length in cm. . .						4·9	8·9	13·0	18·4	24·6	30·5	36·2	41·7	44·4	46·0	48·2

TABLE XXXV.

Trout.[1] **Locality: Chaigijok (Lakselv). Date: July 15—20, 1909.**

Birth-year.		1907			1906			1905			1904			1903			1902			1901		
Length in cm.	Number of Fish Examined.	2 winters.			3 winters.			4 winters.			5 winters.			6 winters.			7 winters.			8 winters.		
		♂	♀	Tot.	♂	♀	Tot.	♂	♀	Tot.	♂	♀	Tot.	♂	♀	Tot.	♂	♀	Tot.	♂	♀	Tot.
10	1	—	1	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
11	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
12	3	1	2	3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
13	2	2	—	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
14	4	1	1	2	—	2	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
15	7	1	—	1	1	—	1	3	2	5	—	—	—	—	—	—	—	—	—	—	—	—
16	7	—	—	—	1	—	1	2	3	5	—	1	1	—	—	—	—	—	—	—	—	—
17	15	—	—	—	1	1	2	6	4	10	1	2	3	—	—	—	—	—	—	—	—	—
18	10	—	—	—	—	—	—	4	3	7	1	2	3	—	—	—	—	—	—	—	—	—
19	12	—	—	—	—	—	—	1	2	3	1	8	9	—	—	—	—	—	—	—	—	—
20	10	—	—	—	—	—	—	2	—	2	2	6	8	—	—	—	—	—	—	—	—	—
21	13	—	—	—	—	—	—	—	2	2	3	1	4	1	6	7	—	—	—	—	—	—
22	7	—	—	—	—	—	—	—	—	—	1	2	3	1	3	4	—	—	—	—	—	—
23	7	—	—	—	—	—	—	—	—	—	2	1	3	—	4	4	—	—	—	—	—	—
24	3	—	—	—	—	—	—	—	—	—	—	—	—	1	—	1	2	—	2	—	—	—
25	5	—	—	—	—	—	—	—	—	—	—	—	—	1	1	2	1	—	1	2	—	2
26	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	—	2	—	—	—
27	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
28	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
29	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
30	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
31	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
32	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Tot.	108	5	4	9	3	3	6	18	16	34	11	23	34	4	14	18	5	—	5	2	—	2
Average		12·8			15·5			17·4			19·7			22·3			25·0			25		

[1] Taken with fly.

TABLE XXXVb.

Trout. Locality: Chaigijok. Date: July 15—20, 1909.

L. No.	Length in cm.	Weight in gr.	Sex.	State of Sex Organs.	Age in Winters.	Calculated Length at Formation of Winter-band.							
						1st	2nd	3rd	4th	5th	6th	7th	8th
1	10	10	♀	—	2	3·5	8·2	—	—	—	—	—	—
2	12	15	♂	—	2	6·1	10·7	—	—	—	—	—	—
3	„	„	♀	—	2	5·7	10·7	—	—	—	—	—	—
4	„	„	„	—	2	5·8	9·8	—	—	—	—	—	—
5	13	20	♂	—	2	6·9	12·0	—	—	—	—	—	—
6	„	22	„	—	2	6·0	10·8	—	—	—	—	—	—
7	14	30	„	—	2	7·4	12·1	—	—	—	—	—	—
8	„	25	♀	—	2	6·8	10·8	—	—	—	—	—	—
9	„	„	„	—	3	6·8	9·2	12·8	—	—	—	—	—
10	„	27	„	—	3	5·8	8·9	13·0	—	—	—	—	—
11	15	30	♂	2	2	8·1	13·2	—	—	—	—	—	—
12	„	„	„	„	4	4·7	9·2	10·2	14·2	—	—	—	—
13	„	„	„	3	4	3·6	6·9	11·4	14·2	—	—	—	—
14	„	„	„	„	4	4·0	8·2	11·5	14·1	—	—	—	—
15	„	35	„	—	3	5·9	9·7	14·0	—	—	—	—	—
16	„	30	♀	—	4	4·3	8·7	11·0	13·9	—	—	—	—
17	„	„	„	—	4	4·1	6·9	10·1	14·0	—	—	—	—
18	16	35	♂	—	4	3·6	7·5	11·8	15·1	—	—	—	—
19	„	40	„	2	4	4·4	8·7	12·7	15·0	—	—	—	—
20	„	45	„	—	3	4·4	9·8	13·8	—	—	—	—	—
21	„	35	♀	2	5	4·9	8·8	11·4	13·4	15·0	—	—	—
22	„	40	„	—	4	3·9	8·4	12·8	15·1	—	—	—	—
23	„	„	„	—	4	4·0	8·4	11·7	14·8	—	—	—	—
24	„	„	„	—	4	4·4	9·8	13·2	14·9	—	—	—	—
25	17	45	♂	—	4	4·6	10·4	14·3	16·0	—	—	—	—
26	„	„	„	—	4	3·9	8·2	11·7	14·8	—	—	—	—
27	„	„	„	2	4	4·7	8·8	11·9	15·2	—	—	—	—
28	„	50	„	—	4	4·0	8·4	12·2	15·5	—	—	—	—
29	„	„	„	2	4	4·7	9·2	12·9	15·8	—	—	—	—
30	„	„	„	2?	5	4·7	8·5	10·8	13·9	16·0	—	—	—
31	„	„	„	2	3	5·4	9·8	15·0	—	—	—	—	—
32	„	„	„	3	4	4·9	7·6	11·8	15·8	—	—	—	—
33	„	40	♀	—	4	4·6	9·5	12·1	14·4	—	—	—	—
34	„	40	„	—	4	3·5	8·0	11·9	15·8	—	—	—	—
35	„	50	„	—	5	3·7	8·1	10·8	14·3	16·2	—	—	—
36	„	„	„	—	4	3·9	9·0	12·6	16·0	—	—	—	—
37	„	„	„	—	4	4·5	7·8	11·4	15·2	—	—	—	—
38	„	„	„	2	3	7·5	11·7	15·6	—	—	—	—	—
39	„	55	„	1—2	5	4·1	8·2	12·9	14·3	15·9	—	—	—
40	18	„	♂	—	4	6·9	12·3	14·5	16·4	—	—	—	—
41	„	„	„	—	4	4·6	11·0	13·8	16·2	—	—	—	—
42	„	60	„	—	5	4·3	8·1	12·8	14·9	16·9	—	—	—
43	„	„	„	2	4	4·6	10·0	14·7	16·9	—	—	—	—
44	„	„	„	2—3	4	4·2	8·0	11·7	16·4	—	—	—	—
45	„	45	♀	2	5	4·9	8·6	12·6	15·5	17·2	—	—	—
46	„	50	„	—	5	4·1	7·8	11·5	15·4	17·2	—	—	—
47	„	„	„	2	4	4·3	8·7	12·5	16·0	—	—	—	—

TABLE XXXVb.—*continued.*

Trout. Locality: Chaigijok. Date: July 15—20, 1909.

L.No.	Length in cm.	Weight in gr.	Sex.	State of Sex Organs.	Age in winters.	Calculated Length at Formation of Winter-band.							
						1st	2nd	3rd	4th	5th	6th	7th	8th.
48	18	55	♀	—	4	5·3	10·1	14·7	17·3	—	—	—	—
49	„	„	„	—	4	4·9	8·7	13·7	16·9	—	—	—	—
50	19	65	♂	2—3	5	5·0	9·4	13·0	16·0	18·0	—	—	—
51	„	75	„	3	4	4·6	10·0	15·9	17·9	—	—	—	—
52	„	55	♀	—	5	4·6	9·5	12·3	15·5	18·2	—	—	—
53	„	60	„	—	4	5·0	9·5	13·1	17·7	—	—	—	—
54	„	„	„	—	4	5·3	10·6	14·6	17·5	—	—	—	—
55	„	„	„	2	5	4·2	7·4	12·2	16·3	18·0	—	—	—
56	„	„	„	2	5	4·5	8·7	12·4	15·6	17·8	—	—	—
57	„	„	„	3	5	5·3	9·4	13·9	17·2	18·1	—	—	—
58	„	65	„	—	5	5·1	8·7	12·7	15·7	17·9	—	—	—
59	„	„	„	—	5	4·1	7·8	10·9	15·5	18·0	—	—	—
60	„	„	„	3	5	4·3	7·8	12·4	16·3	17·8	—	—	—
61	„	70	„	—	5	5·0	10·2	12·8	15·3	18·0	—	—	—
62	20	65	♂	—	4	4·5	10·7	14·7	18·5	—	—	—	—
63	„	70	„	—	5	5·6	10·3	13·5	16·7	19·0	—	—	—
64	„	80	„	2	5	3·9	9·1	13·1	16·0	19·2	—	—	—
65	„	„	„	2	4	5·8	11·9	17·7	19·4	—	—	—	—
66	„	65	♀	2	5	4·6	9·0	13·3	17·2	19·4	—	—	—
67	„	70	„	—	5	4·4	9·8	13·9	17·3	19·1	—	—	—
68	„	„	„	2	5	4·1	7·8	13·1	16·8	19·1	—	—	—
69	„	„	„	2	5	4·3	9·4	13·4	16·3	18·4	—	—	—
70	„	75	„	2	5	4·2	9·4	13·7	16·7	19·1	—	—	—
71	„	80	„	2	5	4·1	9·5	13·7	17·3	19·2	—	—	—
72	21	„	♂	—	5	3·9	10·5	15·3	18·4	20·2	—	—	—
73	„	„	„	2	5	5·1	8·8	12·0	16·2	19·7	—	—	—
74	„	„	„	3	5	3·8	8·3	12·0	16·5	19·7	—	—	—
75	„	105	„	3	6	6·0	11·8	16·6	18·2	19·3	20·2	—	—
76	„	75	♀	2?	5	6·8	12·6	15·7	18·2	19·5	—	—	—
77	„	„	„	3	6	4·8	8·5	12·2	15·8	18·5	20·0	—	—
78	„	„	„	3	6	4·3	9·5	13·4	16·2	18·1	19·8	—	—
79	„	80	„	—	4	5·7	10·2	16·6	19·7	—	—	—	—
80	„	„	„	2	6	4·9	9·5	12·6	15·2	17·6	20·1	—	—
81	„	„	„	2	6	4·7	9·5	12·8	16·7	19·0	20·2	—	—
82	„	„	„	2	4	5·3	12·0	16·3	19·6	—	—	—	—
83	„	„	„	3	6	4·5	8·6	12·2	15·6	18·3	20·1	—	—
84	„	85	„	3	6	3·9	7·2	12·0	15·7	18·2	20·2	—	—
85	22	90	♂	3	6	4·4	8·0	13·0	15·6	19·0	21·1	—	—
86	„	100	„	3	5	5·8	9·5	14·3	18·2	20·9	—	—	—
87	„	90	♀	1—2	5	4·5	9·9	13·7	17·6	21·1	—	—	—
88	„	95	„	1—2	5	4·4	10·2	15·0	18·7	21·0	—	—	—
89	„	„	„	2	6	7·0	11·1	13·8	16·4	19·1	21·3	—	—
90	„	100	„	3	6	5·7	11·4	15·6	18·0	20·1	21·4	—	—
91	„	115	„	2	6	4·2	9·1	13·3	16·8	18·9	21·2	—	—
92	23	105	♂	2	5	3·9	8·6	12·9	17·3	21·9	—	—	—
93	„	110	„	3	5	4·6	9·7	14·6	19·2	22·2	—	—	—
94	„	100	♀	—	6	3·5	6·8	10·1	13·9	18·8	22·1	—	—

TABLE XXXVb.—*continued.*

Trout. Locality: Chaigijok. Date: July 15—20, 1909.

L.-No.	Length in cm.	Weight in gr.	Sex.	State of Sex organs.	Age in Winters.	Calculated Length at Formation of Winter-band.							
						1st	2nd	3rd	4th	5th	6th	7th	8th
95	23	100	♀	2	—	—	—	—	—	—	—	—	—
96	,,	,,	,,	2	5	8·1	15·4	19·0	21·2	22·4	—	—	—
97	,,	,,	,,	3	6	4·8	8·5	12·0	16·0	19·0	21·3	—	—
98	,,	,,	,,	3	6	5·4	10·3	14·2	18·1	20·2	22·3	—	—
99	,,	115	,,	2	6	5·0	10·4	14·5	16·9	20·1	22·4	—	—
100	24	,,	♂	2	6	4·6	10·6	15·3	18·2	21·5	23·0	—	—
101	,,	135	,,	2	7	5·1	10·2	15·2	17·5	19·8	21·9	23·1	—
102	,,	150	,,	2	7	4·3	9·8	15·0	17·4	19·9	21·8	23·3	—
103	25	125	,,	2	—	Useless.							
104	,,	130	,,	2	6	5·1	8·6	12·9	17·0	20·7	23·6	—	—
105	,,	145	,,	2	8	5·5	11·4	14·8	17·2	19·3	21·2	23·2	24·3
106	,,	150	,,	2	7	3·7	8·2	11·3	15·9	18·6	21·3	24·2	—
107	,,	,,	,,	2	8	5·0	9·3	13·1	14·9	17·4	19·7	22·0	24·1
108	,,	140	♀	2?	6	7·6	13·3	16·0	19·3	22·3	24·3	—	—
109	,,	,,	,,	3	—	Useless.							
110	26	155	♂	2	7	4·6	7·7	13·0	17·0	19·9	23·0	25·4	—
111	,,	190	,,	2	7	4·0	7·5	11·0	14·9	18·8	22·0	25·2	—
Average length in cm.						4·9	9·5	13·2	16·4	18·6	21·4	23·8	24·2

TABLE XXXVI.

Trout.[1] Locality: Luostijok. Date: July 17—September 4, 1909.

L.-No.	Length in cm.	Weight in gr.	Sex.	State of Sex Org.[2]	Age in Winters.	Calculated Length at Formation of Winter-band.										
						1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th
1	27	—	♂	—	5	4·9	11·3	15·1	17·8	21·8	—	—	—	—	—	—
2	32	—	,,	—	6	3·9	8·8	14·5	17·8	21·9	27·5	—	—	—	—	—
3	,,	—	♀	—	8	4·8	9·4	11·2	15·1	17·7	20·7	23·8	28·0	—	—	—
4	36	—	♂	—	6	3·9	9·7	15·6	19·9	26·9	33·0	—	—	—	—	—
5	,,	—	,,	—	6	3·8	11·0	17·3	20·3	24·1	29·9	—	—	—	—	—
6	37	500	♀	1	9	5·3	7·6	10·3	13·7	18·1	21·2	24·7	29·3	35·0	—	—
7	39	—	,,	—	6	3·9	9·1	14·8	22·1	28·2	34·7	—	—	—	—	—
8	41	—	♂	—	11	3·7	8·7	10·5	14·4	16·4	19·6	23·0	25·3	27·7	30·2	36·6
9	,,	—	♀	—	9	4·4	7·4	12·1	14·6	16·5	20·9	23·9	27·7	35·9	—	—
10	42	—	♂	—	10	4·9	10·1	12·0	14·7	16·7	18·9	22·2	26·4	32·3	37·2	—
11	43	—	♀	—	10	3·7	8·8	11·0	14·3	17·9	22·3	26·7	31·2	36·8	40·6	—
12	44	—	♂	—	11	3·8	7·0	10·8	14·0	16·4	18·8	23·2	27·8	33·6	38·5	41·8
13	45	1000	♀	3	10	4·3	8·8	12·8	17·5	20·7	23·7	28·3	33·6	38·5	42·7	—
14	47	950	♂	2	11	3·8	6·8	8·9	12·2	17·0	20·6	25·5	31·9	36·9	41·2	45·2
15	48	—	♀	—	10	7·0	10·6	12·6	16·5	18·7	21·0	24·6	34·5	40·6	47·1	—
Average length in cm. . .						4·4	9·0	12·6	16·3	20·5	23·8	24·6	30·6	35·3	39·7	41·2

[1] Taken with spinner and gill-net.

[2] Examined only in three fish.

TABLE XXXVII.

Trout.[1] Locality: Gagavand. Date: August 27—September 18, 1909.

L.-No.	Length in cm.	Sex.	Age in Winters.	Calculated Length at Formation of Winter-band.									
				1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
1	32	♂	5	4·1	9·5	14·8	21·4	28·4	—	—	—	—	—
2	34	♀	6	4·4	9·8	14·6	18·0	21·2	28·5	—	—	—	—
3	35	,,	6	3·8	9·6	15·8	19·5	22·3	28·3	—	—	—	—
4	,,	,,	7	6·4	10·5	14·3	17·0	20·7	24·4	30·2	—	—	—
5	36	,,	7	3·6	7·5	11·5	17·7	21·4	27·4	31·7	—	—	—
6	38	♂	6	4·5	9·7	14·5	18·4	20·4	32·2	—	—	—	—
7	39	,,	6	4·8	9·4	13·1	21·4	27·3	34·3	—	—	—	—
8	40	♀	7	7·5	11·7	16·5	21·2	26·7	32·0	36·8	—	—	—
9	45	♂	8	6·2	10·4	14·6	18·9	22·7	26·7	36·4	42·4	—	—
10	66	,,	10	7·5	13·2	17·0	19·5	22·5	26·1	35·5	50·5	60·0	64·5
Average length in cm. . .				5·3	10·1	15·7	19·3	23·4	28·9	34·1	46·5	60·0	64·5

[1] Taken with gill-nets.

TABLE XXXVIII.

Average Weight of Trout of different Length.

Length in cm.	Number of Fish Examined.	Average Weight in Grammes.	Length in cm.	Number of Fish Examined.	Average Weight in Grammes.	Length in cm.	Number of Fish Examined.	Average Weight in Grammes.
10	2	8·5	41	4	600·0	71	4	4187·5
11	13	11·2	42	6	750·0	72	5	4530·0
12	12	13·8	43	3	800·0	73	3	4966·7
13	39	19·1	44	4	787·5	74	4	4500·0
14	32	23·1	45	2	950·0	75	3	5066·7
15	41	28·5	46	2	800·0	76	4	5350·0
16	30	34·4	47	5	1050·0	77	4	5475·0
17	28	41·0	48	5	1080·0	78	4	6075·0
18	20	50·0	49	5	1150·0	79	4	5600·0
19	26	59·2	50	2	1475·0	80	—	—
20	30	67·8	51	3	1300·0	81	2	6725·0
21	32	78·9	52	1	1500·0	82	2	7325·0
22	41	93·0	53	4	1595·0	83	2	7150·0
23	29	108·8	53·5	1	1700·0	84	2	6800·0
24	45	119·4	54	3	1333·3	85	2	6820·0
25	24	137·9	55	8	1611·4	86	4	8275·0
26	20	159·5	56	6	1941·7	87	3	8833·3
27	30	184·2	57	3	1866·7	88	1	7600·0
28	26	204·8	58	2	2175·0	89	1	8000·0
29	22	222·5	59	4	2400·0	90	4	8412·5
30	17	247·9	60	8	2412·5	91	1	9000·0
31	30	280·2	61	12	2560·0	92	2	9125·0
32	21	302·6	62	6	2438·3	93	—	—
33	24	352·9	63	3	2590·0	94	1	9650·0
34	27	360·9	64	6	2983·3	95	—	—
35	11	421·8	65	9	3077·8	96	1	11700·0
36	11	505·9	66	7	3264·3	97	—	—
37	8	509·4	67	6	3441·7	98	1	11150·0
38	6	511·7	68	3	3733·3	99	1	11600·0
39	5	560·0	69	8	3915·0	—	—	—
40	4	580·0	70	9	4083·3	—	—	—

METRIC WEIGHTS AND MEASURES.

A. Weight.

1000 grammes = 10 hectograms = 1 kilogram = 2·204622 lbs.

Hectos.	Lbs.		Kilo.	Lbs.		Kilo.	Lbs.
1 =	·22	...	1 =	2·205	...	11 =	24·251
2 =	·44	...	2 =	4·409	...	12 =	26·455
3 =	·66	...	3 =	6·614	...	13 =	28·660
4 =	·88	...	4 =	8·818	...	14 =	30·864
5 =	1·10	...	5 =	11·023	...	15 =	33·069
6 =	1·32	...	6 =	13·227	...	16 =	35·274
7 =	1·54	...	7 =	15·432	...	17 =	37·478
8 =	1·76	...	8 =	17·637	...	18 =	39·683
9 =	1·98	...	9 =	19·842	...	19 =	41·888
10 =	2·20	...	10 =	22·046	...	20 =	44·092

B. Length.

10 millimetres = 1 centimetre = 0·3937 inch.

Cm.	Ins.		Cm.	Ins.
5 =	1·968	...	55 =	21·654
10 =	3·937	...	60 =	23·622
15 =	5·906	...	65 =	25·591
20 =	7·874	...	70 =	27·559
25 =	9·843	...	75 =	29·528
30 =	11·811	...	80 =	31·496
35 =	13·780	...	85 =	33·465
40 =	15·748	...	90 =	35·433
45 =	17·717	...	95 =	37·402
50 =	19·685	...	100 =	39·370

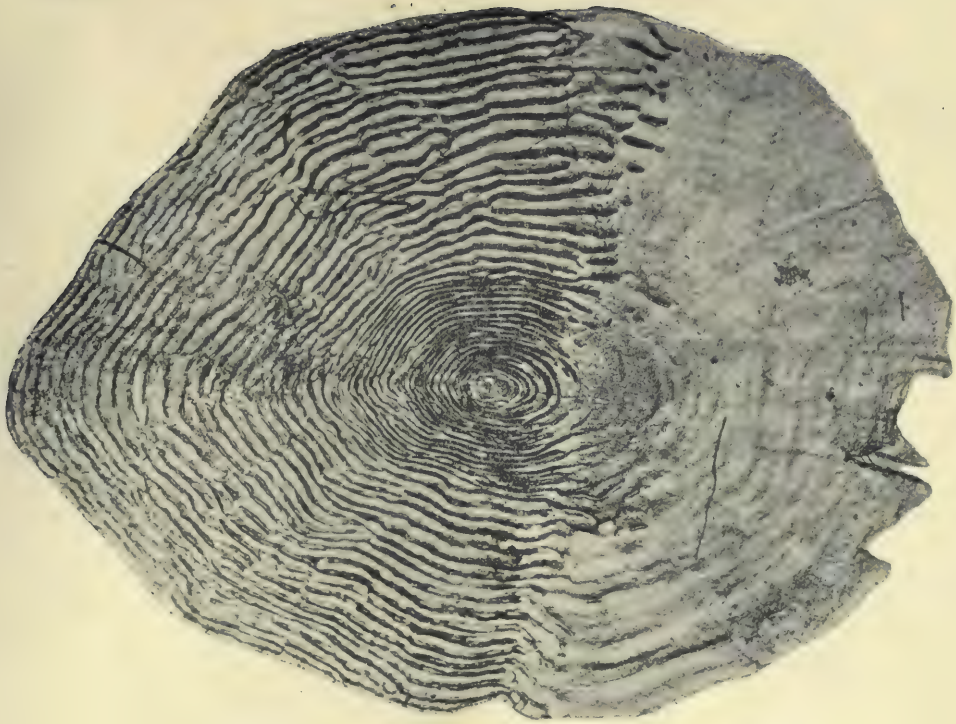


FIG. 8.—SCALE OF IMMATURE GRILSE, 26 CM.
Sandeidfjord, July—August, 1908 × 34.

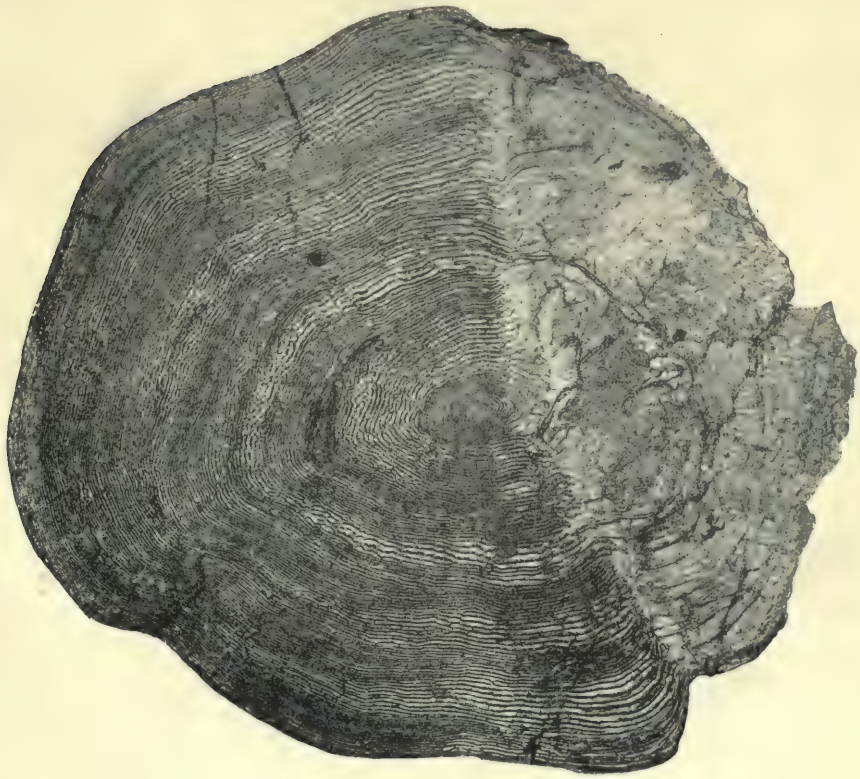


FIG. 12.—SCALE OF SALMON, 29 KGR.

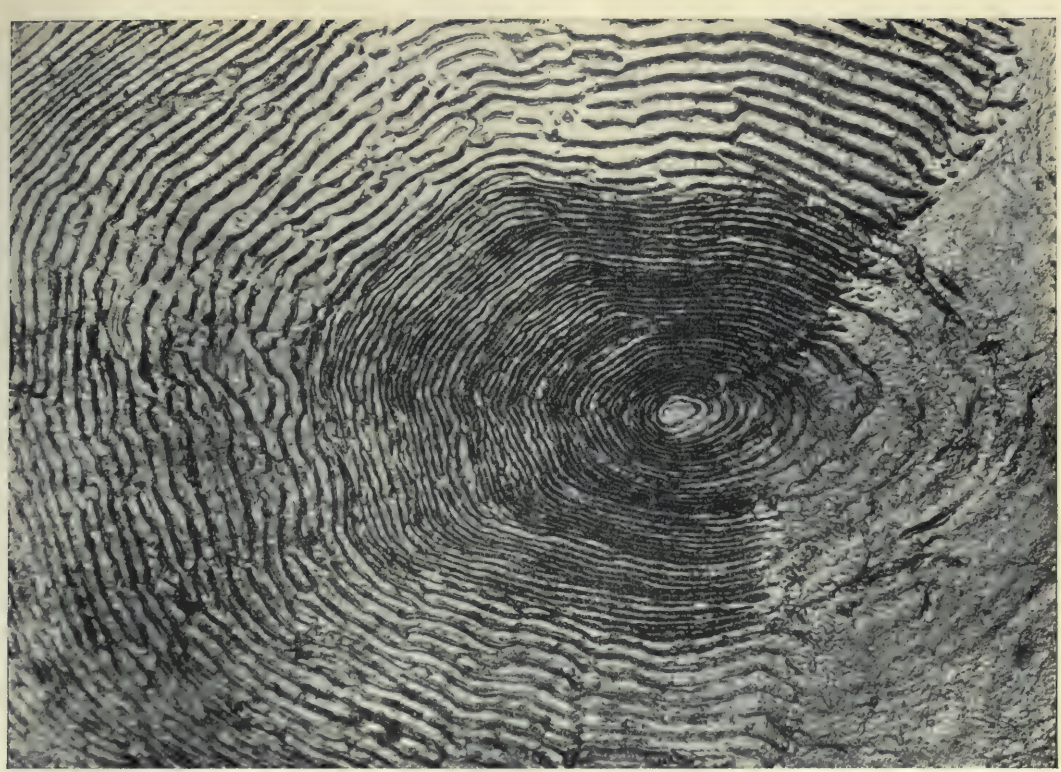


Fig. 9B.—Centre of Scale × 40.

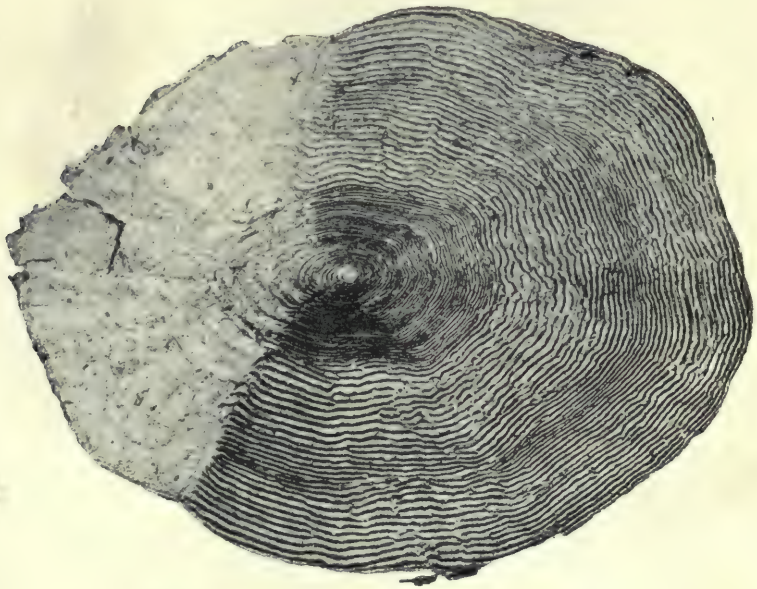


Fig. 9.—Scale of Grilse, 57 cm., 1·9 kgr.
Topdalsfjord, July 8, 1909 × 16. (Hutton fot.)

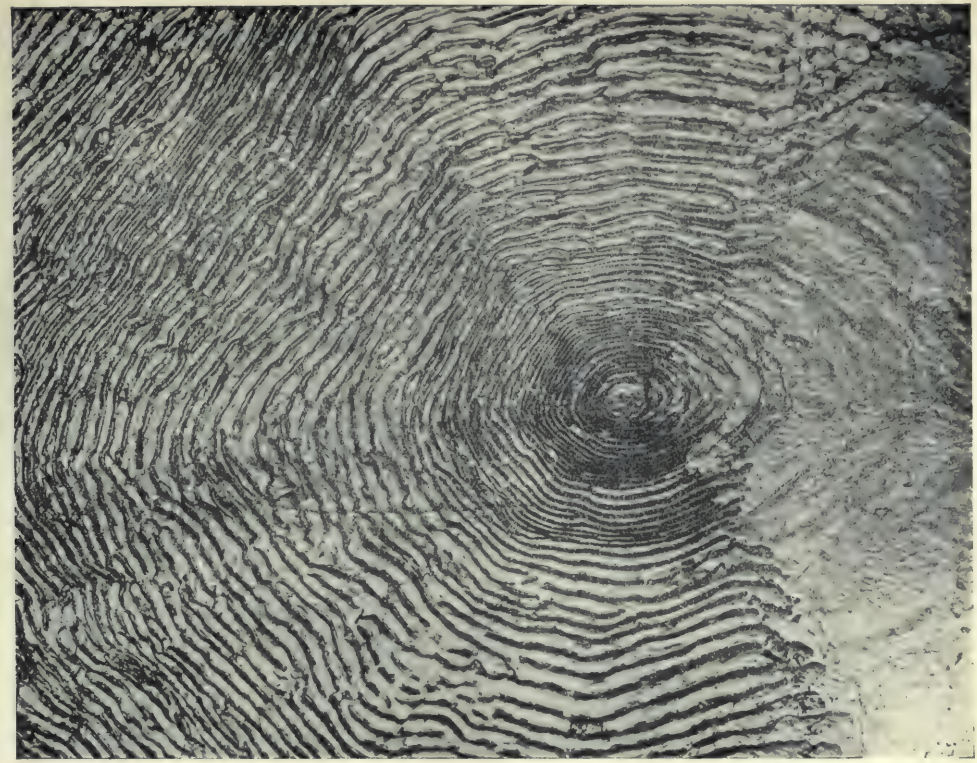


FIG. 10B.—CENTRE OF SCALE × 40.



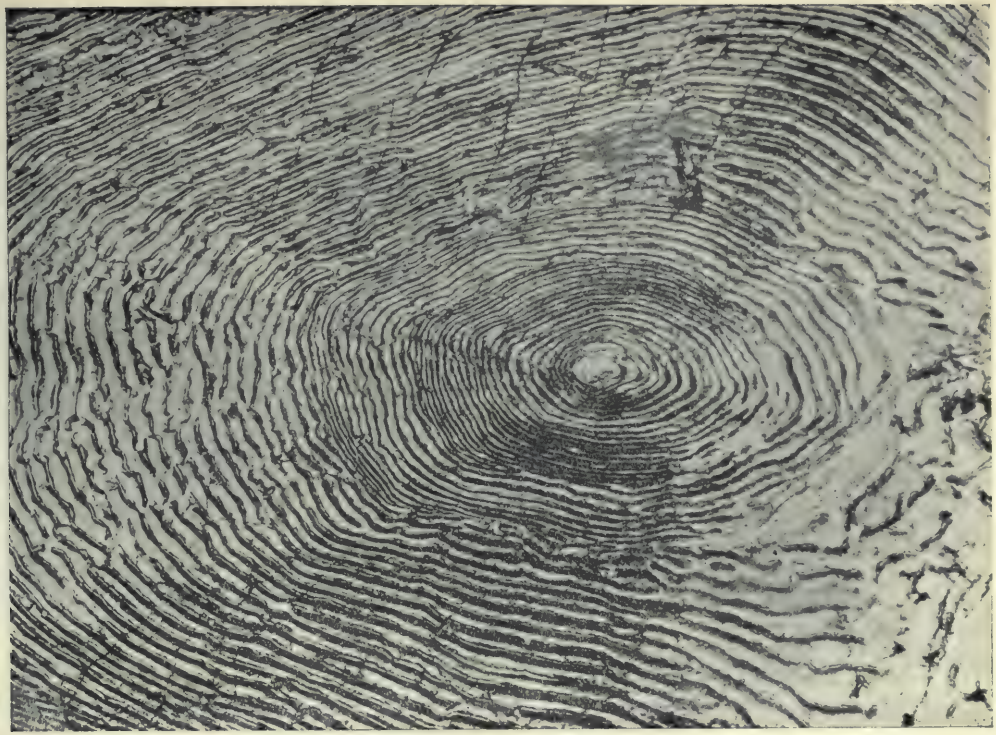


Fig. 11b.—Centre of Scale × 40.



Fig. 11.—Scale of Salmon, 96 cm., 10·5 kgr.
Bugones, Syd-Varanger, June 9, 1909 × 14. (Hutton fot.)

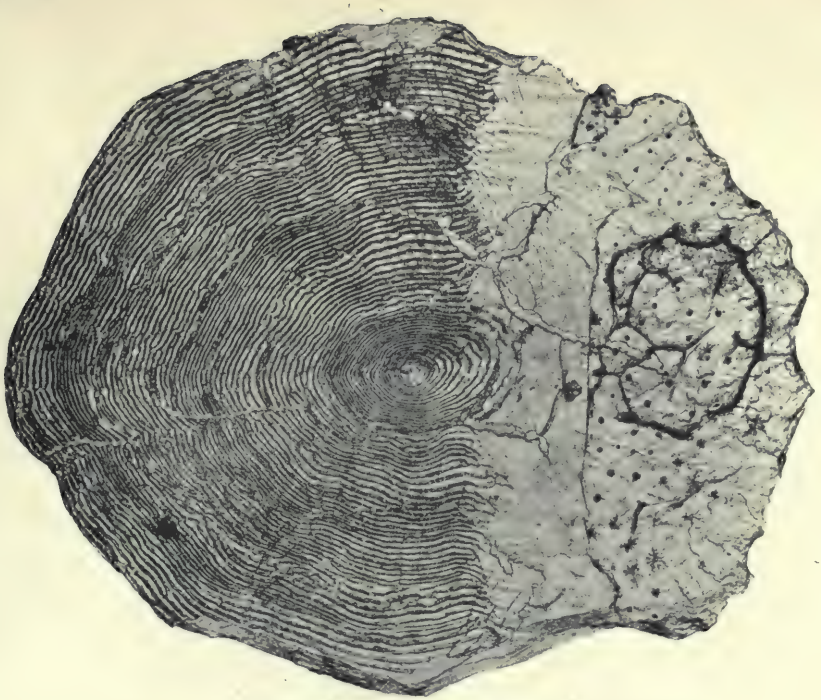


Fig. 14.—Scale of Salmon, 73 cm. (Slightly Worn).
Lærdalselv, October, 1909 × 16.



Fig. 15.—Scale of Salmon, 80 cm. (Moderately Worn).
Lærdalselv, October, 1909 × 16. (Hutton fot.)

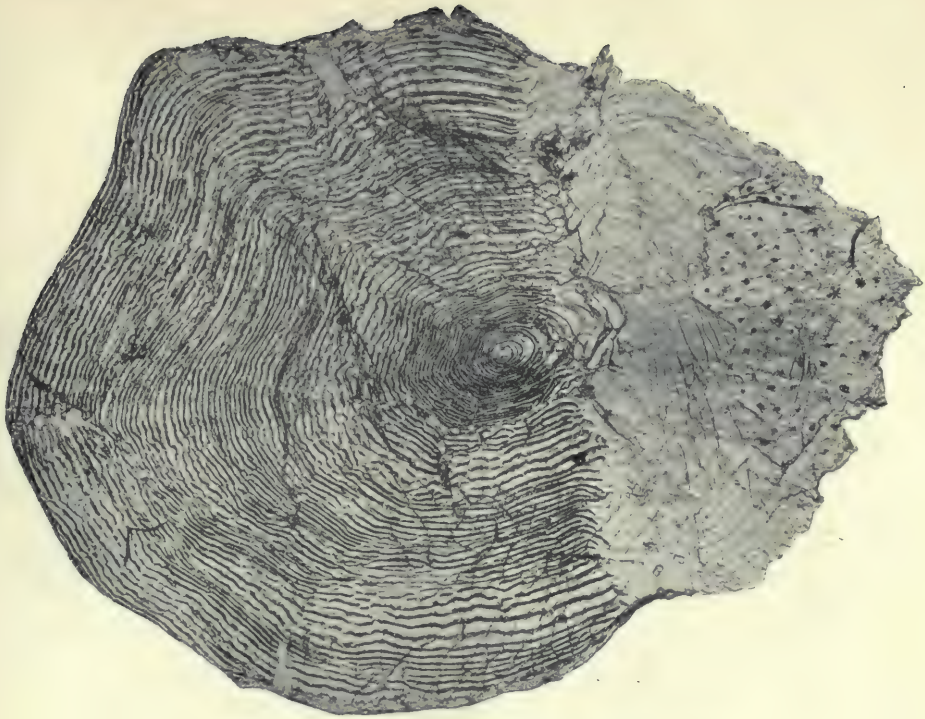
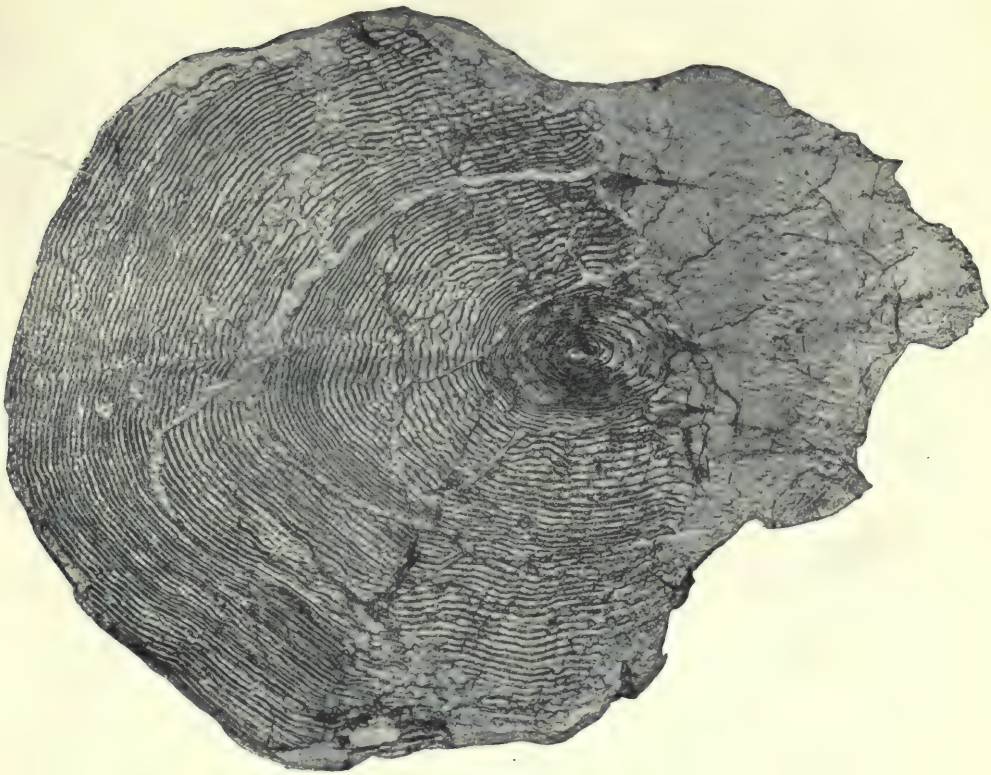


Fig. 16.—Scale of Salmon, 82 cm. (Much Worn).
Lærdalselv, October, 1909 × 16.



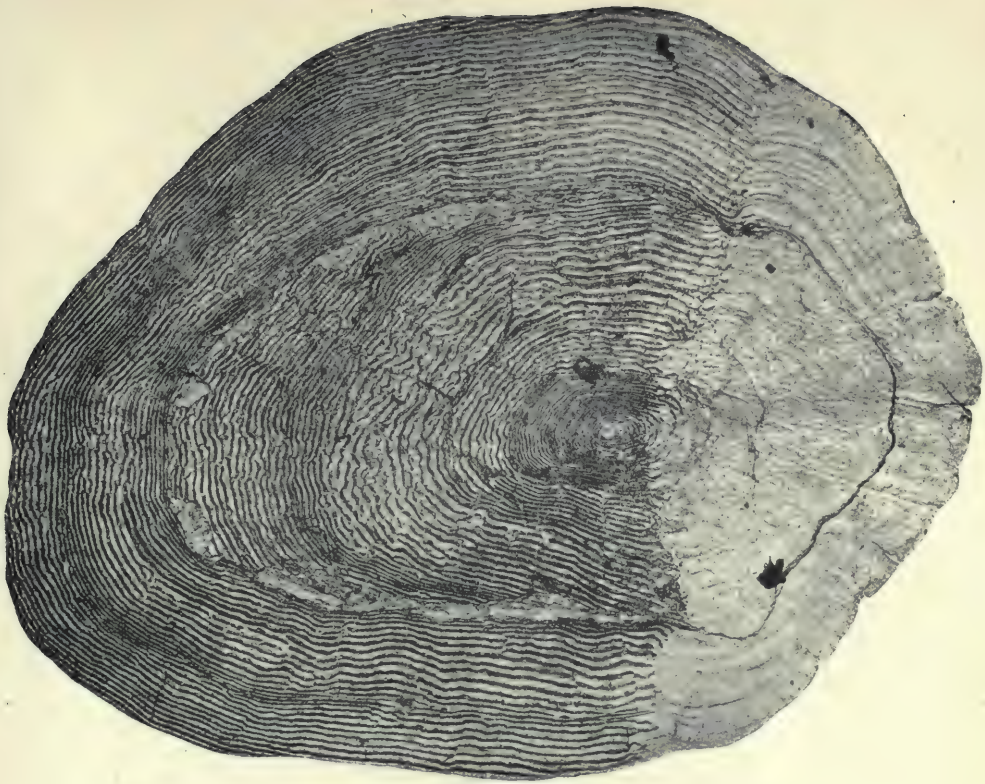
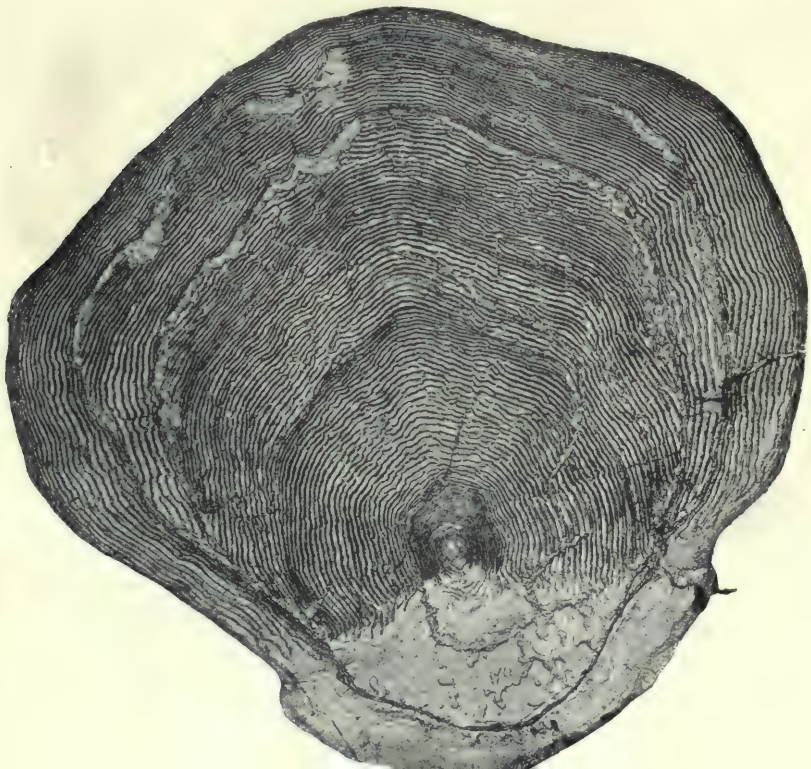


FIG. 18.—SCALE OF SALMON, 84 CM., 6·4 KGR. (1 SPAWNING MARK).
Mandal, June 5, 1909 × 15½.



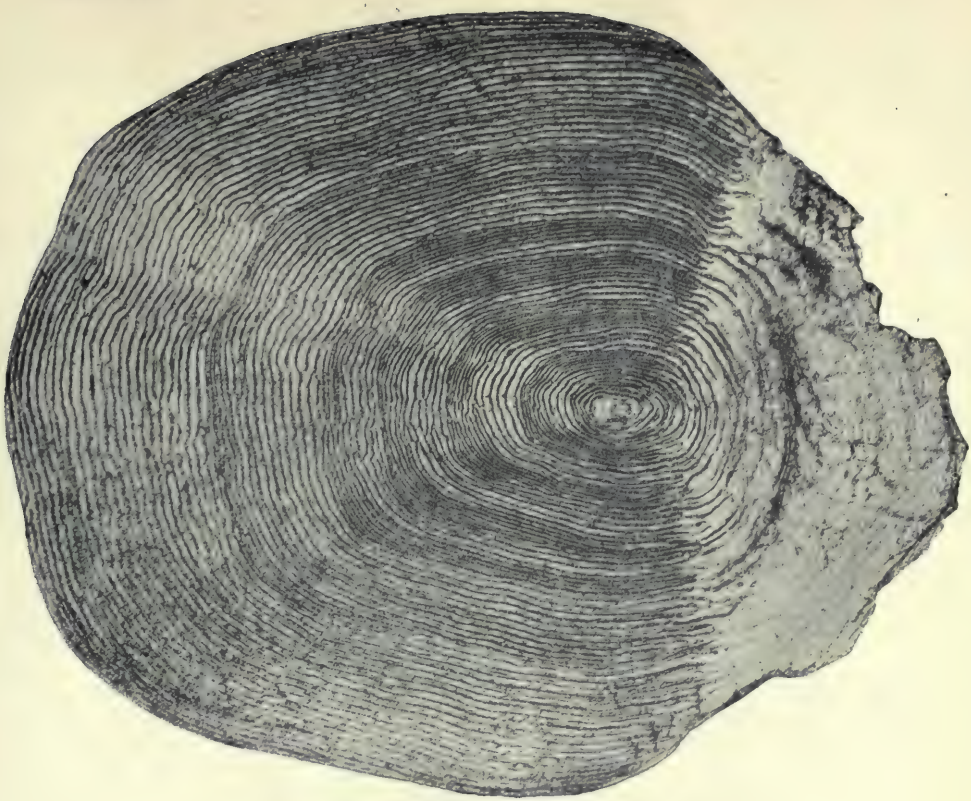


FIG. 22.—SCALE OF MJØSEN TROUT, 56 CM., 2·0 KGR.
Laagen, August 15, 1909 × 27.



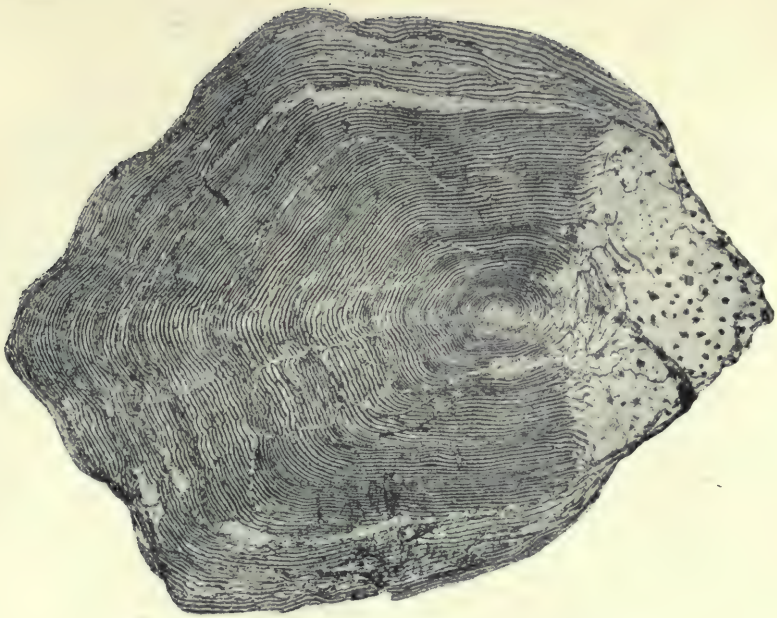


Fig. 24.—Scale of Mjøsen Trout, 81 cm., 6·0 kgr.
Laagen, August 2, 1909 × 16.

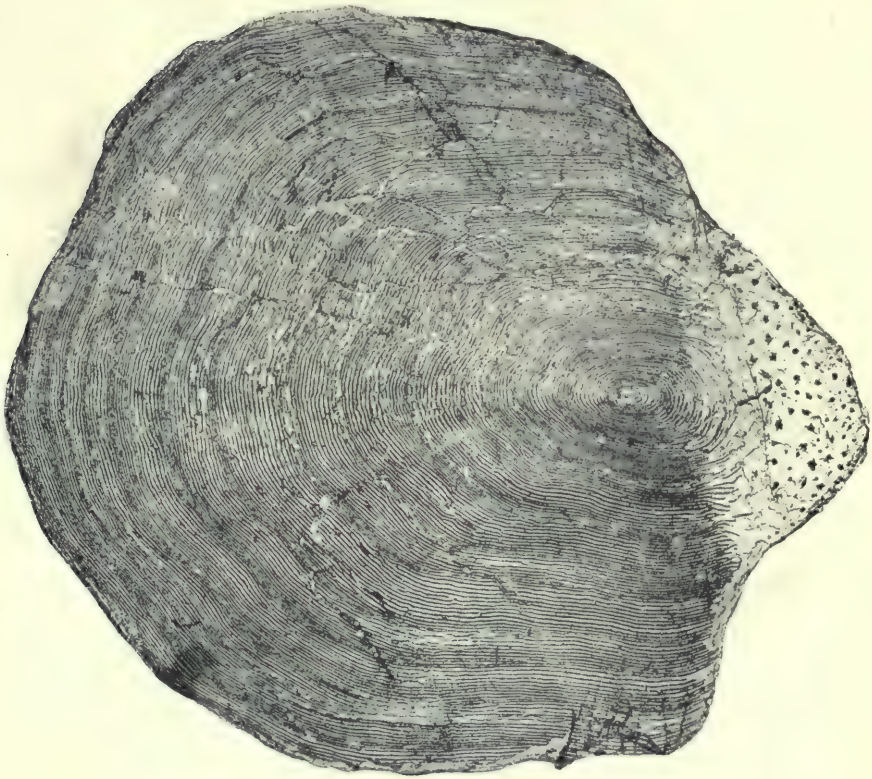
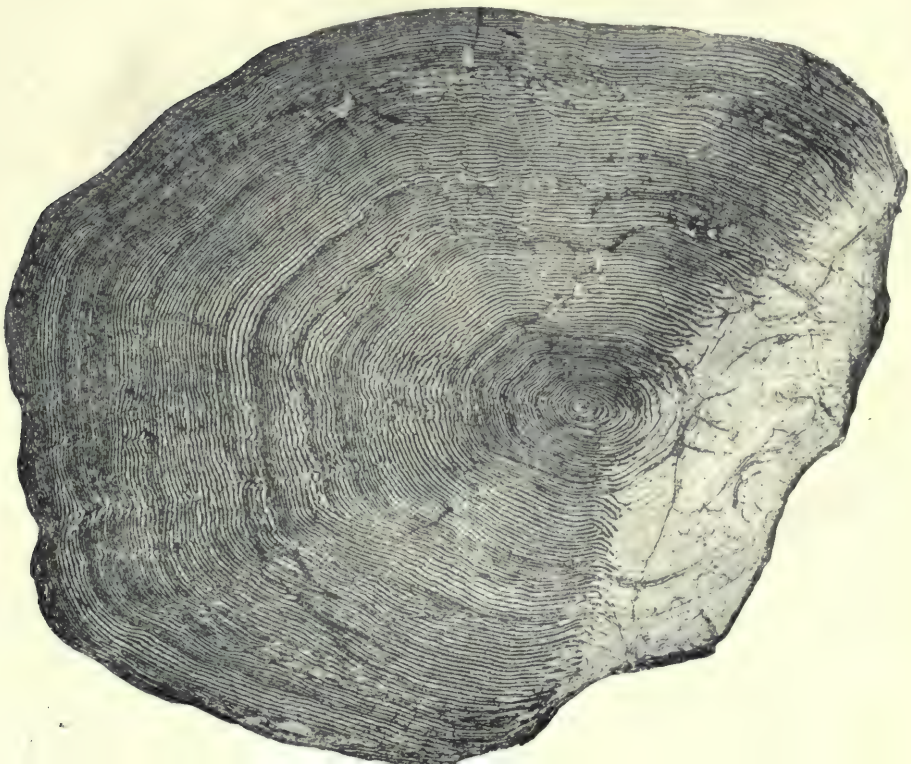
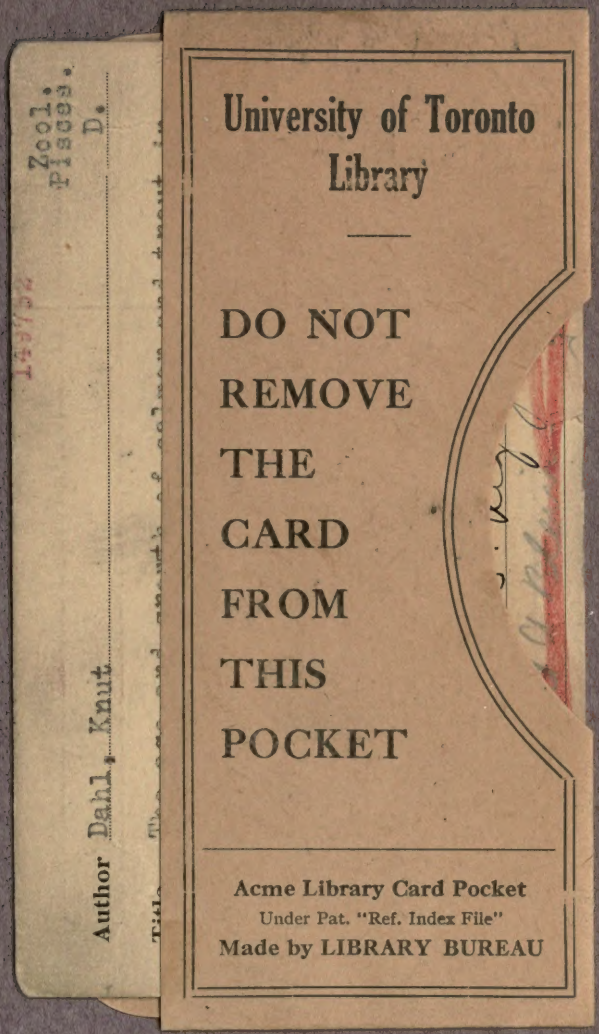


Fig. 25.—Scale of Mjøsen Trout, 99 cm., 116 kgr.
Laagen, September 2, 1909 × 15. (Hutton fot.)



FIG. 33.—SCALE OF TROUT, 36 CM., 650 GRAMMES.
Laugen, Trondenes, August, 1909 × 35.




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D.

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